Consulting Engineer

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October 1956

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CARLTON S. PROCTOR, of Moran, Proctor, Mueser & Rutledge, is three times a Doctor of Engineering — by way of Drexel Institute, Fenn College and Princeton, where he also received his professional degree and on whose board he serves as a trustee. He also has an Honorary Civil Engineer degree from Rensselaer Polytechnic Institute. Besides these evidences of academic honors, Proctor is known as an internationally recognized expert in the

—Continued on page 6

1000 BRINELL DURACASE TRIM...

Stops galling and erosion

Since the introduction of OIC's Duracase Trim, many forged steel valve specs are obsolete. This 13% chrome stainless steel trim with 1000 Brinell, case-hardened wedges and discs assures positive protection against even the simultaneous attack of the three valve-destroying agents—corrosion, erosion, galling.

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VOLUME 8 NUMBER 4

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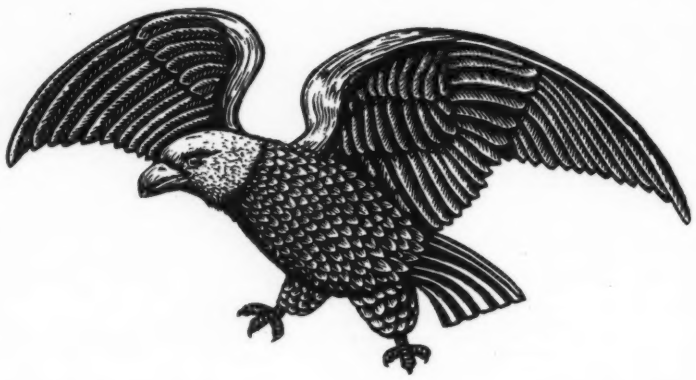
The Consulting Engineer's Professional Magazine

Carlton S. Proctor —

Starts on front cover

field of foundation engineering, for his excellent work with professional and technical societies, and for the high offices he has held in these organizations. He has held many offices in the American Society of Civil Engineers, including their highest, that of a national president, a position he occupied in 1951-52, their Centennial Year. He was president of the Federation of Pan-American Engineering Societies (U.P.A.D.I.) in 1952, and he has served for many years as chairman of the National Engineers Committee of Engineers Joint Council. This is but a brief sampling of the offices and honors that have been Carlton Proctor's since he began the practice of engineering, in 1919.

This year he is president of the American Institute of Consulting Engineers, an organization founded in 1910, and set up to include "engineers in any recognized branch of the engineering profession who are practicing as consulting engineers of high character and who have attained an honorable reputation and distinguished position." The objectives of the institute are "to encourage the practice of engineering as a profession, promote ethical principles and procedures, advance the interest of engineers in all branches of the calling, but particularly those of the consulting engineers, and to increase the usefulness of the vocation to the general public."



Carlton Proctor, as the President of AICE, is intensely interested in the future of that organization of consulting engineers.

An Important Period

"This is an important period in the engineer's long quest for the attainment of true professional status. It is hoped that our objective may be advanced by the development of associations formed to further the interest of the engineer in private practice," Proctor pointed out. "Until just a few months ago, the Institute was the only national group designed to represent consulting engineers, but now there are two other organizations operating on a national scale. One is the Professional Practice Functional Group of the National Society of Professional Engineers; the other is the newly formed Consulting Engineers Council, a federation of state and regional associations of consulting engineers. While the membership requirements of the local organizations are quite different from those of the Institute, to permit admission in age and in employment classifications that would be ineligible in the Institute, such membership does include many prominent engineers fully eligible for Institute membership.

Possible Conflict

"It has been suggested that there might be some conflict between the objectives and activities of the Institute and the Council. We do not see it that way. In fact, the Institute adopts the position that there may be a real need for the type of work the Council contemplates, and it is certainly a good thing to bring state and regional societies together, so that they can exchange information and work as a group, where that is advisable.

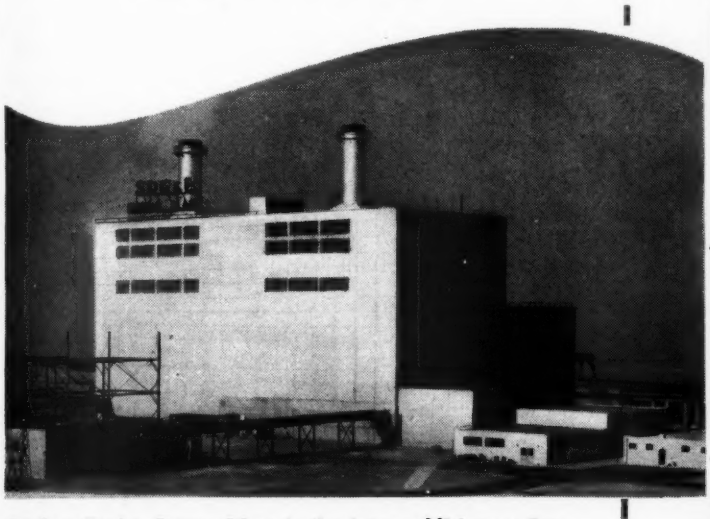
"The organizations of the Council are local in nature, encompassing only the area of a state or of a few contiguous states. Hence there exists a demand for cooperation for the exchange of information on ethics, fees, and national problems affecting the profession. In fulfillment of its obligation to its own members who are also members of local organizations, the American Institute of Consulting Engineers has established a Committee on Cooperation with consulting engineering organizations. That committee stands ready to assist through guidance in the integration of basic principles, such as ethics and fees, in the conviction that the problems of professional practice in any area are bound to become the problems of others areas. Our Committee on Cooperation has been directed by the Institute to cooperate with local organizations that desire ties to a national institute, acting through members of the Institute who are residents in the areas of such local organizations.

Reverse Objectives

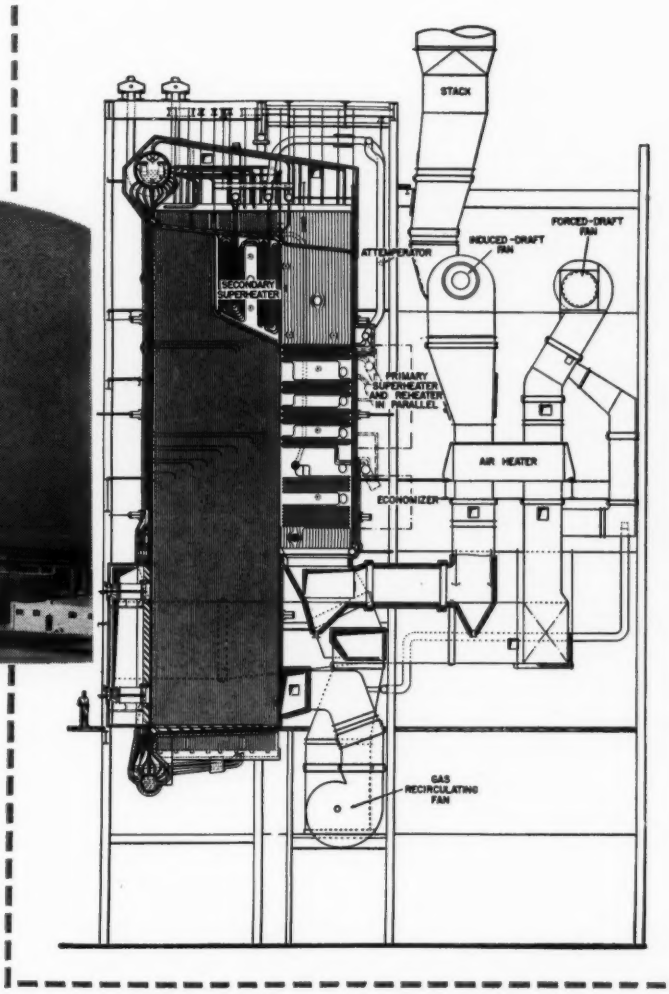
"There can be no conflict in objectives as between the local groups, or their organization into a Council, and the Institute. It might be put that whereas the objectives of the Institute are to promote the professional, ethical, and financial well-being of engineers in private practice, the objectives of the Consulting Engineers Council are to promote financial, ethical, and professional well-being of engineers in private practice. While such objectives are the same, the fact that they are necessarily in reverse order means that there should be no conflict.

"The American Institute of Consulting Engineers, by its basic set up and insistance on distinguished accomplishment, is a small organization. Currently we have something over 200 members; and even for

B&W Radiant Boilers at Encina are fired with oil or natural gas, with provision for future use of coal. Each unit produces 775,000 lb of steam per hr. Pressure is 1550 psi and temp. 1000 F, with reheat to 1000 F. Design features gas recirculation and cyclone steam separators for natural circulation. Boiler design pressure is 1725 psi.



Modern Encina Power Plant is the latest addition to San Diego Gas & Electric Company's expanding facilities. With two units already in operation, excavation is already underway for a third unit which is scheduled to be in operation in 1958. The design engineering firm is Pioneer Service and Engineering Company, Chicago, Illinois.



San Diego Gas and Electric Company's

ENCINA POWER PLANT

installs New B&W Radiant Reheat Boilers to assure low maintenance—efficient steam generation

Since 1941, this progressive utility has increased its generating capacity almost five times. Its capital investment has grown to about 200 million dollars, and still further expansion is scheduled beyond 1958.

Concrete evidence of this foresighted policy is the new Encina Power Plant. Unit No. 1 went on the line in 1954. Unit No. 2 was placed in operation in July of this year.

Steam at Encina is generated by B&W Radiant Reheat Boilers. These boilers with their turbines and generators increase generating capacity by 212,000 kw—three-eighths of the system total. These are the 34th and 35th B&W boilers to be installed by this utility since 1903. Their choice for Encina is a reflection of long service satisfaction.

B&W boilers are products of 90 years of boiler engineering and construction experience, plus advances gained through B&W's continuing, intensive research and development activities. This strong combination has but one purpose—to build better boilers to help raise steam-electric power generation to new levels of efficiency. The Babcock & Wilcox Company, Boiler Division, 161 East 42nd Street, New York 17, N. Y.

G-816-C5

BABCOCK & WILCOX

BOILER DIVISION

the distant future, our program is to hold the membership to approximately 300. We feel that our purposes and self-imposed limitations define our Institute as one intended to appeal only to well established consulting engineers in independent practice. We mean the older men who are recognized as outstanding members of their profession in a practice not adjunctive to contracting, manufacture, or the separate practice of architecture; men who are not primarily interested in improving their financial status, because the financial or business aspects of the profession are no longer of first interest to them. Such men are primarily interested in aiding the growth of engineering as a profession.

"The Consulting Engineers Council is essentially and organically a different type of organization — a type undoubtedly much needed. Many of its prospective members are much interested in the relationship of the consulting engineer and the architect, in establishing mutally acceptable manuals of fair practice, based on experienced ability rather than on over-emphasis on fee. Certainly, such an organization is needed, and the larger and stronger it gets, the better for all engineers in private practice and for our quest for 'status.'

Balanced Membership

"But to get back to the Institute, we know that it has been open to criticism in the past as being a 'New York Luncheon Club for Distinguished Engineers.' At one time that might have been partially justified. Certainly, for a national organization we had too great a part of our membership in the Metropolitan area. That has been changed. We have adopted a plan for gradually increasing our membership and for spreading it throughout the country, through a quota system whereby selection of new members each year will increasingly provide a geographically balanced membership in a more truly national organization. We have improved that balance considerably in recent years, and it will continue to improve.

"The AICE proposes to orient a positive program for cooperative liaison with local or regional consulting engineer organizations having membership requirements that are strictly comparable to its own; or with local chapters of the Institute. The Institute's Committee on Cooperation, charged with this responsibility, has recommended the creation of local chapters and of five regions, comparable to the zone system of ASCE. It has suggested the desirability of an Institute Vice President for each such zone. It is the declared policy of the Institute to offer to members of local organizations who meet the Institute's more exclusive requirements for membership, the advantage of AICE membership and to provide the desired national integration.

"We now have active membership Sub-Committees in each of the five zones, and the chairman of each such Sub-Committee will not only help keep our membership geographically balanced, but will keep the office of the Institute informed of activities in his region and act as a regional representative of the Institute.

Works With EJC

"The Institute has its offices in the Engineering Societies Building in New York, and we have always worked closely with the Founder Societies and with Engineers Joint Council; we have applied for EJC associate membership. That has been one of the more important aspects of our work—to represent consulting engineers in the EJC activities. Also, we work closely with each of the Founder Societies individually. For example, we will hold our 1956 Annual and Award Dinner in connection with this year's annual meeting of ASME, on November 27 next, at the Waldorf, in New York. We are holding a most significant dinner meeting of the Institute with the ASCE at the time of their annual convention meeting in Pittsburgh on October 16 next. We are also working with both ASME and ASCE on a Manual of Practice for consulting engineers. One interesting aspect of this manual is that the published charts for fee schedules will show curves for median fees rather than minimum fees. The use of median fees as a guide avoids driving all engineers to the minimum fee level.

International Groups

"We have given a lot of thought, over a number of years, to affiliation with the International Federation of Consulting Engineers, the federation bringing together many of the national associations of consulting engineers of Europe. We have never accepted their invitation to join them, and I seriously doubt that we will. FIDIC is a federation of excellent associations of consulting engineers, undoubtedly with an important job to do, but perhaps their aims and activities come closer to matching the proposed aims and activities of the Consulting Engineers Council than to ours. Our foremost objective, at the moment, is to become truly national, with a geographically balanced and active membership. This, in itself, currently eliminates any international aspirations.

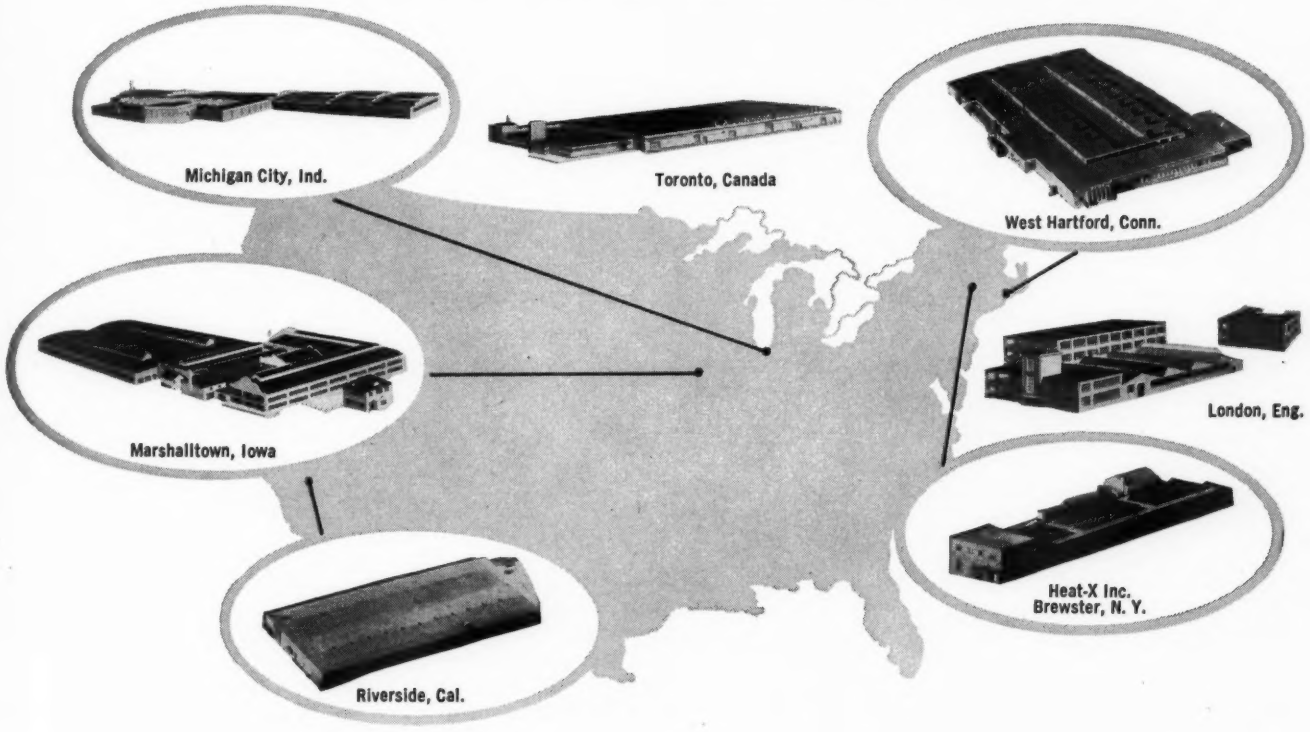
Planned Progress

"If our objective, so far as size is concerned, seems conservative, that is because we believe that a group such as ours progresses best if it moves forward slowly. We are making good progress according to a carefully thought out plan. Our influence far exceeds our number, for our members are the recognized and established engineers in private practice, men who have great influence, not only in private practice but as leaders of the entire engineering profession." ▲▲

BUSH

TEAMED WITH DUNHAM

FOR EVEN GREATER GROWTH



Heating, air conditioning and refrigeration products are flowing from the recently formed Dunham-Bush manufacturing facilities.

This "one-source" teaming of Dunham and Bush spells many advantages for architects, engineers, wholesalers and contractors.

A nationwide network of manufacturing plants and strategically located warehouses assures the "close-to-source" supply that permits faster delivery, lower freight costs. A substantially expanded force of sales engineers makes available on-the-spot engineering and application assistance. Greatly augmented resources and facilities permit continued research and development of new products to serve an expanding field.

Dunham-Bush . . . *a single source, single responsibility* for heating, air conditioning and refrigeration . . . teamed to serve an industry's growing needs.

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Have Wendnagel Design and Build Your . . .

"corrosion resistant" Processing & Storage Equipment of Wood

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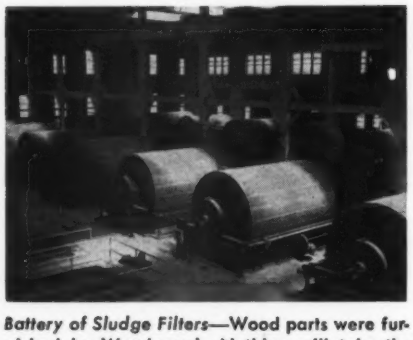
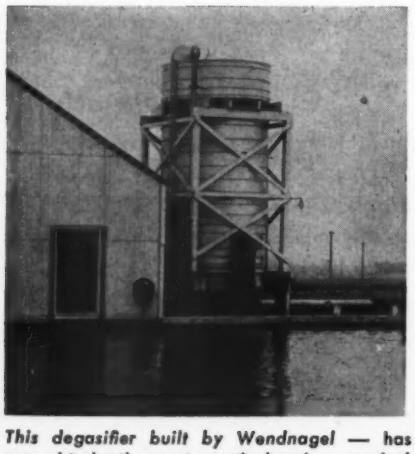


Battery of Sludge Filters—Wood parts were furnished by Wendnagel. Nothing will take the place of WOOD for long life and low maintenance.



This degasifier built by Wendnagel — has proved to be the most practical and economical type of equipment for this job.

Send us details of your requirements for solution.

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READERS' COMMENT

Stand on Ethics

Sir:

Once in a long while, somebody publishes an article that confirms my thinking. I must say it took considerable fortitude for you to publish "Scraps & Shavings" in the September issue. You have said very beautifully what I felt, but was unable to express, when that Amendment to the ASCE Code of Ethics was being voted upon.

Congratulations on this kind of an editorial stand!

Ralph M. Westcott
Holladay & Westcott
Los Angeles, Calif.

What Is Justice?

Sir:

The letter in your September 1956 issue from engineer Henry Hagel of Baltimore reveals a trend that is becoming more and more prevalent. As the pressure of rapid advancement and technological progress becomes too great for some public officials, the tendency is to place their responsibility on someone else. In this case officers of the City of Baltimore failed in their duty to see that the building code was enforced and "passed the buck" on to the engineer, who had no control over the actions of the builder.

The other bone of contention revealed in Mr. Hagel's letter is the method of securing justice as practiced by our courts . . . the court in the person of the judge must sit back and permit statements to be admitted as evidence or withheld because of legal technicalities which result in what many times is a series of statements, each correct in itself, but adding up to something other than the truth . . . In this case if the attorneys defending Mr. Hagel had asked Mr. Suda in cross-examination if the drawings in question contained all the information necessary to appraise the strength of the proposed structure, the truth might have come out...

Any outside individual who criticizes the court system is derided or ignored, but if some publication similar to CONSULTING ENGINEER were to gather together records of such obvious miscarriages of justice as this and through co-operation of members of the bar who are also critical of our present court system show the others of the bar that there is a considerable force of public opinion in professional circles towards revisions to close the present gap between what is legal and what is justice, something might be accomplished...

Adrian M. Matthews
Prof. Engineer and and Surveyor
Bristol, Conn.

Why Not?

Dear Sir:

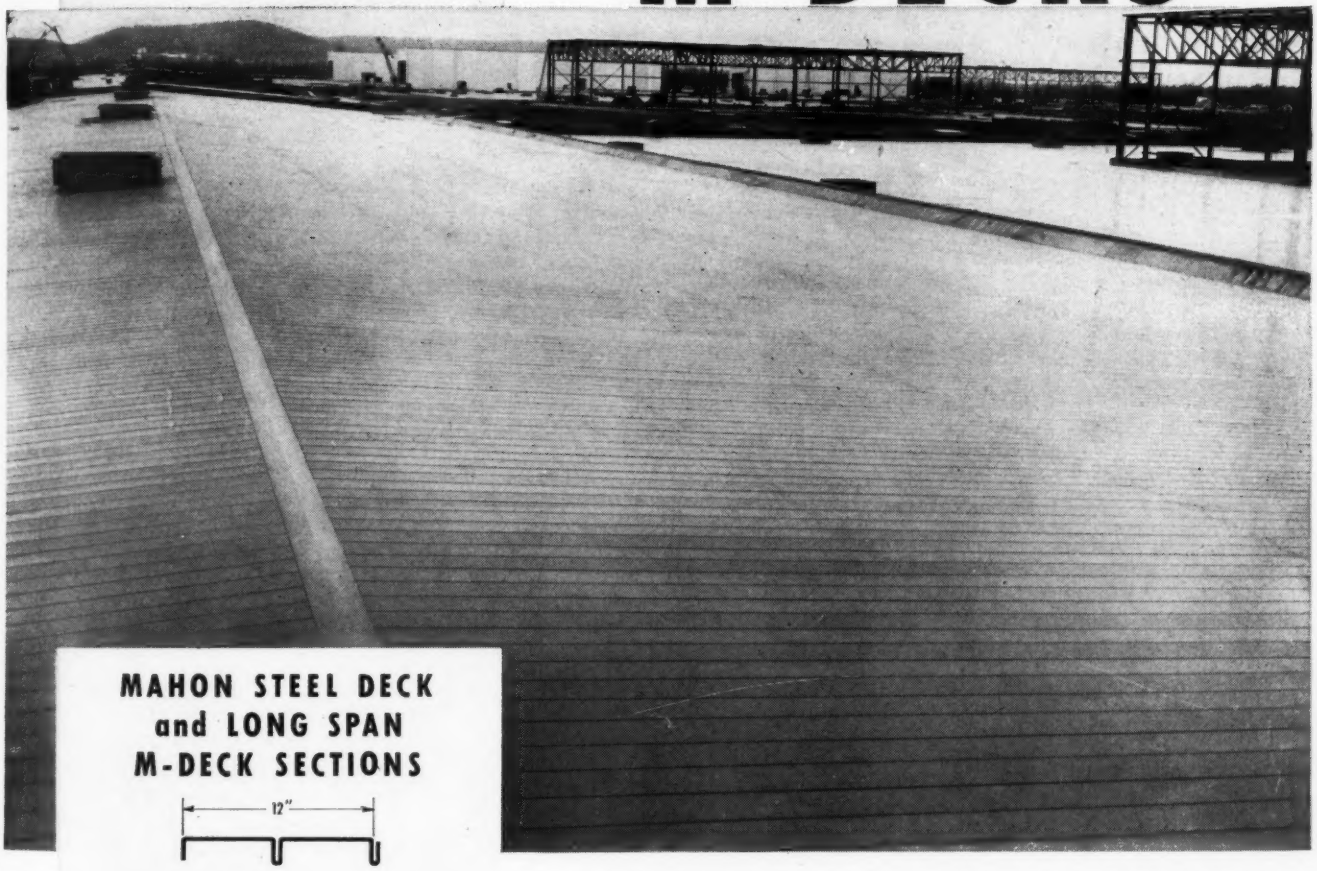
There has been much discussion in the press and elsewhere on the subject of the shortage of engineers, but why not have helpers to relieve engineers of time-consuming extra duties?

I first read of the idea recently in connection with the nurse and school teacher shortages, and it struck me as furnishing a smart, practical way to lick the growing shortage of engineers which, together with our growing demand for highly trained technical personnel, is one of our major, most immediate national problems.

In brief it is this: hire competent engineers' aides, or non-professional assistants who know how to assist engineers and preferably have some desire to become engineers, to assist the regular licensed engineers by relieving them of time-consuming, non-professional duties.

Give them work which requires mostly patience and common sense,

STEEL DECK
and LONG SPAN
M-DECKS



MAHON STEEL DECK and LONG SPAN M-DECK SECTIONS

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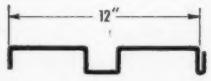
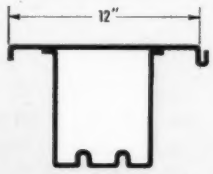
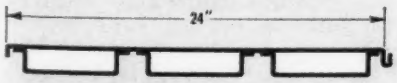


WIDE-FLANGE DOUBLE RIB



LONG SPAN M-DECK SECTION M1

LONG SPAN M-DECK SECTION M2



LONG SPAN M-DECK SECTION M3

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Mahon Standard Double Rib Steel Deck is still the most practical material for modern roof construction . . , it is used to roof a greater percentage of new construction year after year. There are two good and logical reasons for this: It weighs less per sq. ft. and it costs less per sq. ft. than any other type of permanent roof building material. And now that Long Span M-Decks are available in a number of Structural Sections and Acousti-Structural Sections that meet virtually any requirement in roof construction and combined roof/ceiling construction, STEEL, employed as the structural unit and interior finish material as well, will roof even a broader range of building types. Long Span Acousti-Structural Sections may be employed as shown for a beamed ceiling effect, or reversed for a flat metal ceiling surface. Noise Reduction Coefficients range from .70 to .85 for various Sections. Mahon Acoustical and Troffer Forms are also available for recessed lighting in acoustical ceilings of concrete joist and slab construction. See Sweet's Files for information, or write for Catalogs D-57 and M-57.

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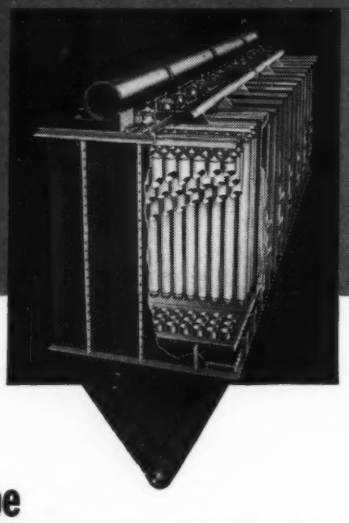
MAHON

Dust and Fume Collection by Norblo

helps you achieve efficiency and cleanliness in your plant



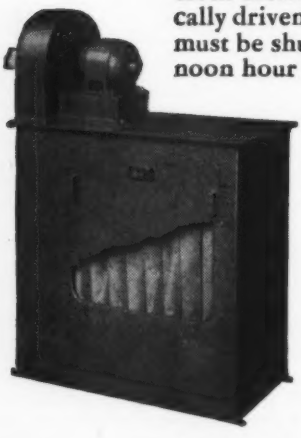
Norblo has developed bag type dust collection systems to a high degree of efficiency.

Norblo Automatic Bag Type

For continuous and heavy duty service at constant capacity and efficiency, Norblo Automatic Bag Type collection pays its own way — in recovery of valuable materials or removal of injurious or "nuisance" industrial air contaminants. Norblo builds the entire installation, from blowers to bag-cleaning mechanisms. Complete systems are engineered to meet specific situations. Norblo engineering insures low maintenance and no shut-downs — guarantees performance of every installation.

Norblo Standard Bag Type Collectors

Based on the same construction principles, the standard bag type collectors provide at low cost the high efficiency service that is obtainable only from bag-type cloth filtering, with either compressed air or electrically driven periodical bag shaking and cleaning. Units must be shut down for cleaning — at such times as the noon hour and end of working day.



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For excellent results in localized dust control, Norblo Portables protect equipment and reduce maintenance in grinding, polishing and cutting departments. Six models cover capacities from 300 to 1350 cfm., at 8″ static pressure at the fan. Occupy small space. Are unusually quiet.

Write for bulletins describing Norblo bag type dust collectors.

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Norblo ENGINEERED DUST COLLECTION SYSTEMS FOR ALL INDUSTRIES

in much the same way that nurses' aides have taken over many of the chores that registered nurses used to perform in hospitals . . .

In these days of abounding engineering activities, which are going to increase astoundingly in the next 10 years, why doesn't this plan make sense? Are there any engineering organizations, industries, or government agencies trying it or willing to try it?

Raymond J. Rosenberger
The H. F. Ferguson Co., Inc.
Cleveland, Ohio

Interesting Reading

Dear Sir:

One of the most interesting periods of each month is the time employed in reading CONSULTING ENGINEER. I consider it one of the best of the many engineering journals that I receive and I greatly appreciate being one of those favored to receive it.

Edmund B. Besselievre
Consulting Engineer and Mgr.
Industrial Wastes Div., Kaighin & Hughes and K & H Engineering Co.
Toledo, Ohio

Dear Sir:

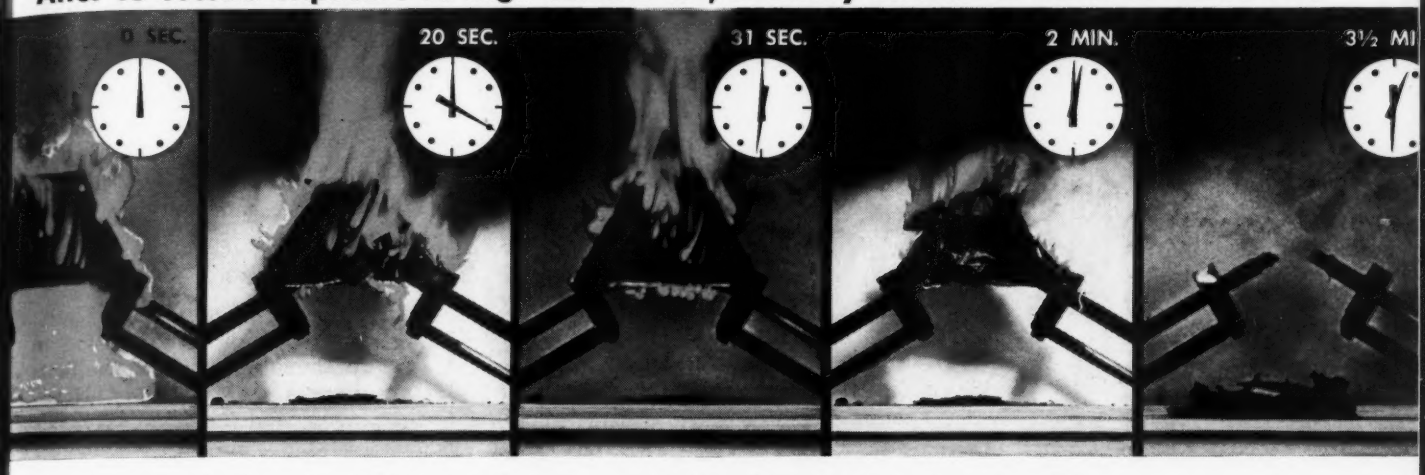
In undertaking the publication of CONSULTING ENGINEER, you have done the profession a great service, and you certainly deserve commendation for your efforts. The technical articles and, particularly, the news pertaining to the furtherance of the profession, are of great interest to me, since my work prevents me from keeping in close touch personally.

Charles M. Lockhart
Morrison-Knudsen Intl. Co., Inc.
San Francisco, Calif.

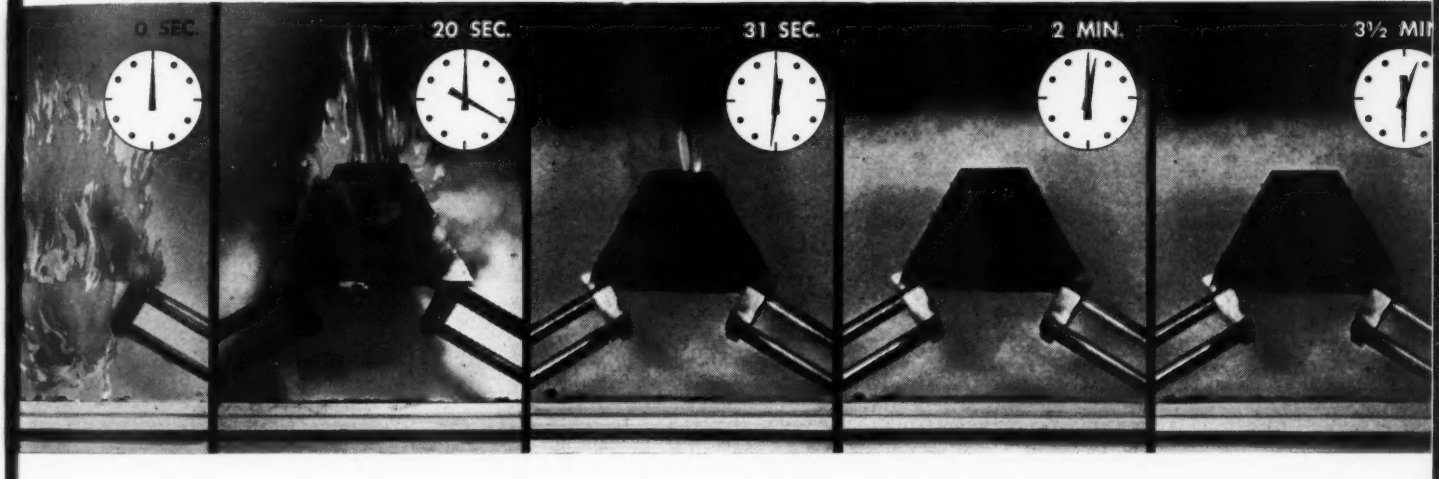
Sir:

I have just been appointed editor of "The Louisiana Engineer," which is the official publication of the Louisiana Engineering Society. As such I have the responsibility of presenting information of interest to all branches of engineering in our state. One of the finest magazines in the engineering field is your publication. I have been reading it since the first issue and believe that there are many fine articles which would be appreciated by my readers. Since these readers are probably not reached by your magazine I would like to request your permission to reproduce them, giving full credit to your publication and author. In particular I would appreciate using the articles "Errors and Omissions Insurance" and "Consulting Engi-

After 10 second exposure to high current arc, ordinary insulation burns to ashes . . .



. . . General Electric Self-x insulation quenches fire in just 31 seconds



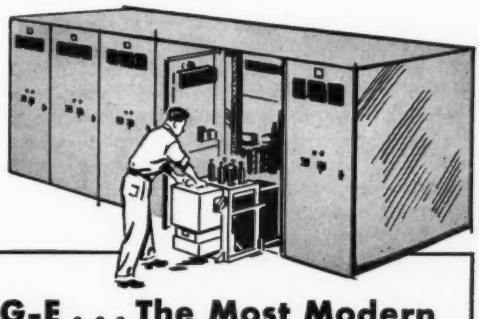
Here's Why General Electric Metal-clad Switchgear Provides Maximum Fire Protection

Just 31 seconds—that's how long it took General Electric's new Self-x insulation to quench the flame after direct exposure to a high current arc for 10 seconds. Ordinary insulation, subjected to the same test, burned until nothing was left but a pile of smoldering ashes. This "baptism by fire" furnishes conclusive proof that recently improved Self-x insulation provides users of G-E Metal-clad Switchgear with unsurpassed fire protection.

Built for rugged duty in service where reliability and continuity count, failures are extremely rare. To protect against this remote case, Self-x flame retardant insulation helps protect vital points. Should fire ever occur, compartments would be accessible within seconds after the source was removed. "New Self-X Polyester Glass Insulation" will give you the full story. For your copy of this new publication, see your G-E Apparatus Sales Representative, or write for Bulletin GER-1193, Section 511-16, General Electric Company, Schenectady 5, New York.

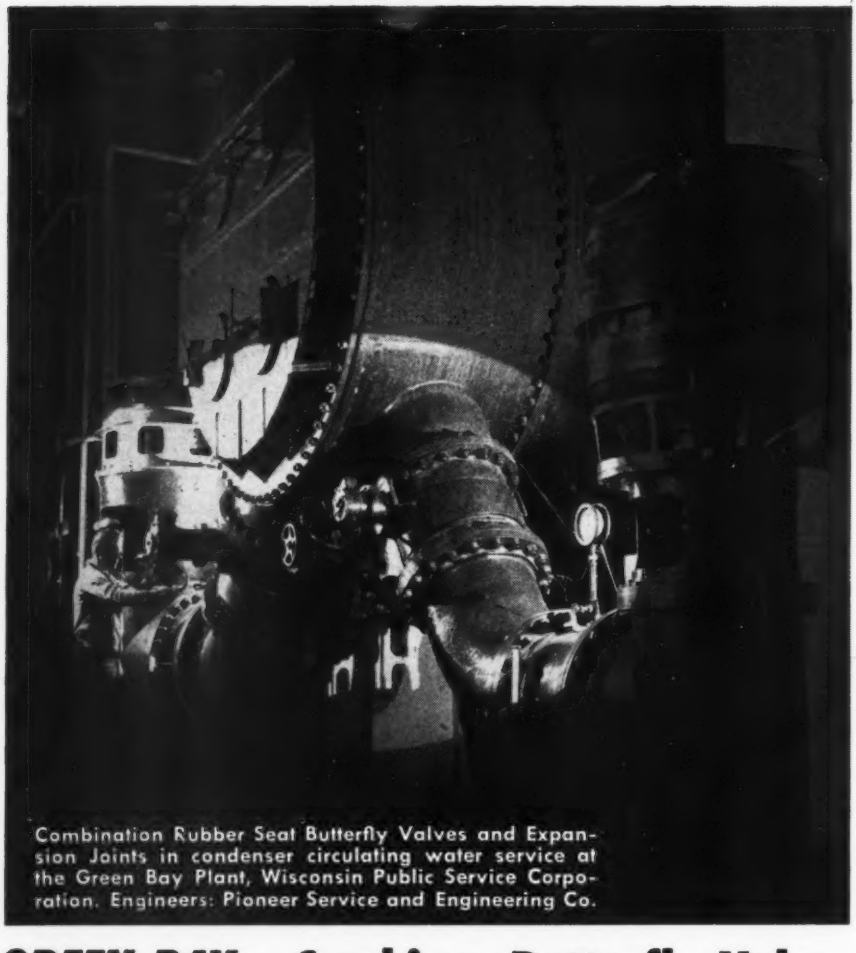
Progress Is Our Most Important Product

GENERAL ELECTRIC



G-E . . . The Most Modern Metal-Clad Switchgear You Can Buy

- NEW SELF-X INSULATION
- BETTER MOTOR PROTECTION
- EASIER, SAFER HANDLING
- HIGHER RATINGS
- 5-CYCLE CLEARING TIME
- EASIER MAINTENANCE
- EXTRA STRONG FRAME



Combination Rubber Seat Butterfly Valves and Expansion Joints in condenser circulating water service at the Green Bay Plant, Wisconsin Public Service Corporation. Engineers: Pioneer Service and Engineering Co.

GREEN BAY...Combines Butterfly Valves with expansion joints for new economy

Drop-tight shutoff, plus provision for pipeline expansion and ease of assembly are provided here in one compact Pratt unit. By combining the Butterfly Valve with the expansion joint, space requirements are minimized and maintenance (and initial cost) of one set of flanges and bolts is eliminated. This is a typical Henry Pratt engineering job—the mechanisms are the simplest available . . . for economy and minimum maintenance, and they are carefully designed and built for peak efficiency and operating ease.

Henry Pratt pioneered the use of Rubber Seat Butterfly Valves in power plants. Combined with permanently drop-tight shutoff, the inherent simplicity and compactness of this valve permitted a new concept of large-diameter valving by power plant engineers.

Pratt Rubber Seat Butterfly Valves grew with the Power Industry for thirty years, and today are being installed in modern, nuclear power plants. For valve design—with **Imagination**—see Henry Pratt.

NEW! Latest, most accurate pressure drop and flow data, conversion tables, discussion of butterfly valve theory and application plus other technical information.

Write for Manual B-2-J.

HENRY PRATT

RUBBER SEAT

Butterfly Valves

Henry Pratt Company, 2222 S. Halsted St., Chicago 8, Ill. Representatives in principal cities

neer Council Formed" from the August 1956 issue.

Chester A. Peyronnin, Jr.
School of Engineering
Tulane University
New Orleans, La.

• PERMISSION GRANTED.

Looking for Himself

Sir:

I have been much interested in your recent staff report "Consultants Can Hire the Men They Need" (May 1956) and the comment headed "Looking" in your September edition.

Our friend is in the position of many engineers, but fortunate for him he is yet at an age that is much in his favor. He is old enough to have had the necessary experience and yet young enough to have a full career ahead of him.

I think the consultant this man is looking for is himself. To get above that "plateau of minor administrative level" he must become a consultant, as an associate or alone.

Raymond J. Rosenberger
Consulting Engineer
Bay Village, Ohio

Dear Sir:

I became quite interested in an item called "Looking" . . . in the September issue.

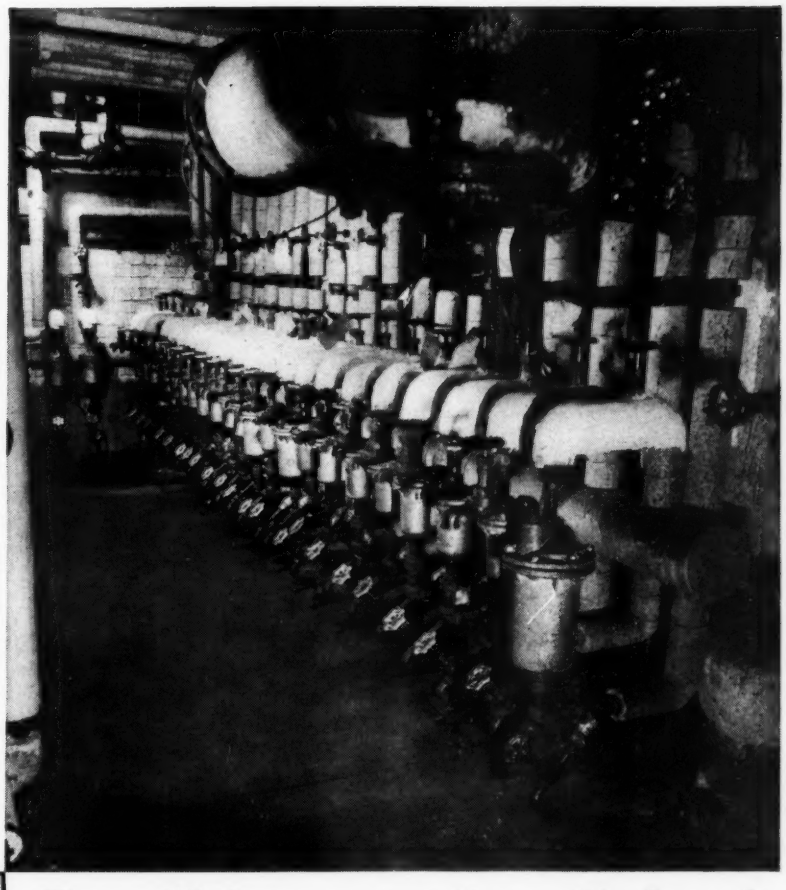
The Ohio Society of Professional Engineers have a service which attempts to help men of the type discussed in this article. It is a nonprofit corporation, and it always will be in the position of either having a large number of engineers for whom no jobs are available or a large number of jobs for whom no engineers are available. We primarily started out to find a position for men who desired a change and were unable to help themselves . . .

Some men feel they are in a round hole and should be in a square one. They might feel there is no future for them in the present organization to which they are connected . . .

We attempt to take care of the engineer who desires a change on the basis of an interview, his background as indicated to us, together with a statement from him as to what positions or firms he is not interested in us contacting for him. Our service to the individual professional engineer is personal and, as far as possible, a personal orientation service if desired.

We find a great many men of the type indicated in this article. The officers of this organization are handling this work gratis. We do a great deal of counseling, investigating, and

How Steam Trap Standardization *reduces* *Installation and Maintenance Work and Cost*



No Bypasses Needed. Traps can be replaced in a couple of minutes by uncoupling the unions and installing a "spare" trap complete with proper length pipe connections and half unions.

ORIFICE SIZES	
PRESSURE	SIZE
0-40	7/16"
40-60	5/16"
60-150	1/4"

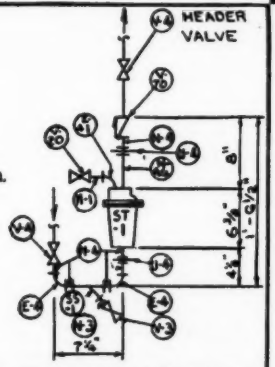
CAPACITY-0-300#/HR

NOTES:

DIMENSIONS SHOWN ARE FOR MINIMUM SPACE INSTALLATION.

IN LONG RUNS - PIPE TO BE PITCHED TOWARD TRAP.

TRAP TO BE INSTALLED BELOW DRAIN POINT IF POSSIBLE. IF NOT POSSIBLE, A CHECK VALVE MUST BE INSTALLED ON INLET SIDE OF TRAP.



BILL OF MATERIAL FOR TYPICAL STEAM TRAP HOOK-UP

MARK	REQD	MAT'L	DESCRIPTION
ST-1	1	ARMSTRONG	1/2" STEAM TRAP - ARMSTRONG #211
SS-1	1	CAST STEEL	1/2" STRAINER - 250# W.S.P. - [redacted]
V-4	2	BRZ	1/2" GATE VALVE - SCRD - 200# W.S.P. - [redacted]
V-20	1	BRZ	1/2" GLOBE VALVE - SCRD - 200# W.S.P. - [redacted]
V-3	1	BRZ	1/2" GATE VALVE - SCRD - 200# W.S.P. - [redacted]
V-70	1	BRZ	1/2" CHECK VALVE - SCRD - 200# W.S.P. - [redacted]
E-4	2	FRGD. STL.	1/2" - 90° SCRD ELL - 2000#
E-41	1	FRGD. STL.	1/4" - 90° STREET ELL - 3000# - [redacted]
U-4	2	FRGD. STL.	1/2" UNION - 2000# - [redacted]
N-1	1	STL	1/2" SHORT NIPPLE - SCH. 80 - SEAMLESS ASTM A-53
N-3	1	STL.	1/4" SHORT NIPPLE - SCH. 80 - SEAMLESS ASTM A-53
N-4	6	STL.	1/2" SHORT NIPPLE - SCH. 80 - SEAMLESS ASTM A-53
N-4/4	1	STL.	1/2" - 4" LG. NIPPLE - SCH. 80 - SEAMLESS ASTM A-53

Standardized hookup includes test valve for trap testing, strainer, blowdown valve for cleaning trap, shut-off valves and unions for quick replacement.

Trap Maintenance Costs Reduced $25,000 per Year with Armstrongs

Major reductions in steam trap installation and maintenance work and cost can be achieved by standardization on one make of trap which, in turn, permits standardized hookups. A major chemical company reports an annual maintenance saving of $25,000 since installing 4000 Armstrong traps according to the drawing and photograph shown here. Additionally, trap parts inventory is reduced and purchasing is simplified.

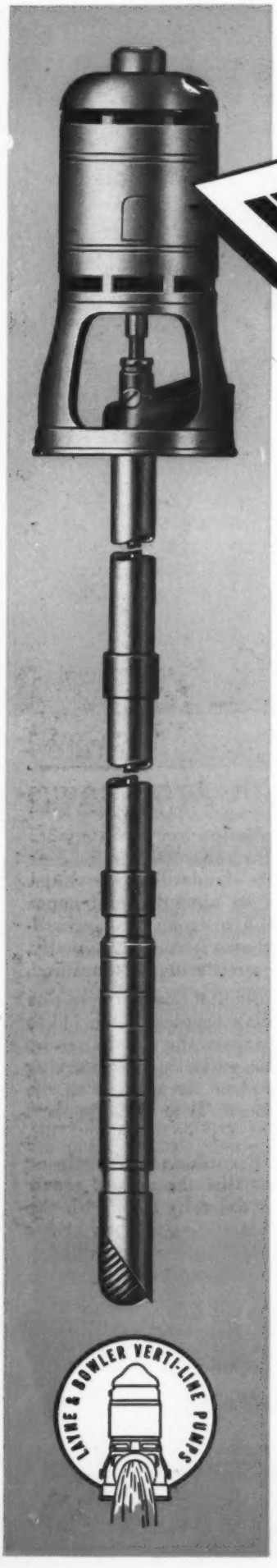
Traps of a Size Interchangeable. Note that exact dimensions are given for the pipe fittings, including nipples connected to each size of trap. When a trap needs repair, the unions can be uncoupled, the trap lifted from the line, and a "spare" carrying identical pipe connections slipped in place. In as little as one or two minutes, a faulty trap is replaced. It is then repaired and takes its place as a "spare".

$25,000 Trap Maintenance Saving. Records on the Armstrong trap installation described here show that the cost of repair parts was approximately $10,000 less annually than with the traps previously used. Reduction in maintenance labor brings the total saving to $25,000, per year. *And, fuel savings attributable to the traps are at least equal to the maintenance saving.*

FOR COMPLETE INFORMATION on the traps that slash maintenance costs ask for the Armstrong Steam Trap Book containing complete data plus selection, installation and maintenance recommendations. Call your local Armstrong Representative or write.

ARMSTRONG MACHINE WORKS, 965 Maple Street • Three Rivers, Michigan

ARMSTRONG STEAM TRAPS



IT'S NEW!

THE
Verti-Line
PACKAGE-PUMP

A Small Unit for Big Jobs

For Wells as small as 4"
2 Thru 7½ Horsepower
Capacities to 7500 GPH

The design of the Verti-Line Package-Pump is based on the highly efficient, performance-proven Verti-Line Deepwell Turbine Pumps – for nearly half-a-century the outstanding leader in the turbine pump field.

YOU GET MORE WATER PER HORSEPOWER WITH THE VERTI-LINE PACKAGE-PUMP ***Write today for complete details about the money-saving features of this sensational new vertical turbine pump.***

Send for free literature.
Ask for Bulletin D-106

Verti-Line Pumps are the exclusive products of
LAYNE & BOWLER PUMP COMPANY
general offices and main plant
2943 VAIL AVENUE • LOS ANGELES 22, CALIFORNIA

correspondence with various persons. In addition, we have a staff in Columbus, who we feel are doing an excellent job . . . The files are not open for general analysis, and our only reason for being in existence is to help the licensed professional engineer to advance himself in his profession and by so doing, be a bigger asset to his community . . .

Perhaps this gentleman whose name was not attached would be interested in discussing his problem a little further . . .

We are taking this opportunity to discuss the matter with you as we feel that you are spending a great deal of time and effort to develop a field for consulting engineers on the basis that they are primarily professional men and not technicians.

Charles E. Hatch
Pres. and General Mgr.
Ohio Engineers' Placement Service, Inc.
Columbus, Ohio

CE Group for Washington

Sir:

This is to advise that the Consulting Engineers Association of Washington has finally become a reality. An enthusiastic group met on August 17 in Seattle to elect temporary officers. A slate of nominations for permanent officers will be submitted for election at the next meeting in about a month's time.

W. O. Stevens
W. O. Stevens & Co.
Seattle, Wash.

New Reader

Sir:

You will find enclosed herewith completed application taken from your most recent issue of CONSULTING ENGINEER. Having become recently registered in the state of Illinois and meeting the stated qualifications, I would appreciate receiving your magazine.

R. G. Michael
Chicago, Ill.

Hit Home

Dear Sir:

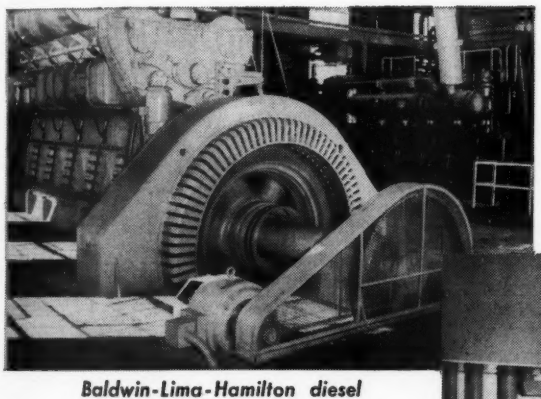
We have enjoyed very much your August '56 issue. In particular we find the article by Milo Ketchum entitled "The Consulting Structural Engineer" to be a concise and comprehensive review of conditions in our own field. He has expressed very well many of the points which we have found by bitter experience.

Howard F. Eckerlin
Eckerlin & Klepper
Syracuse, N. Y.

DE LAVAL AC-VO CENTRIFUGE SAVES EDMUNDSTON $30,638 IN ONE YEAR!

The City of Edmundston power plant in New Brunswick adds another story of tremendous savings through the use of residual fuel—purified by De Laval.

With #2 diesel fuel costing 15½¢, and residual 9¼¢ per gallon . . . there is a gross savings of 6¼¢ per gallon when residual fuel is used. Mr. L. Long, Electrical Superintendent says: "A total of 490,216 gallons of #6 fuel was burned from May 1, 1955 to May 1, 1956. *Gross savings amounted to $30,638.50.*



Baldwin-Lima-Hamilton diesel engine at City of Edmundston power plant in New Brunswick.

De Laval AC-VO "Nozzle-Matic" Continuous Purifier at City of Edmundston plant.

Mr. Long says "the De Laval AC-VO removed some 5,280 gallons of sludge. The engine operated 4912 hrs. on heavy fuel. A thorough inspection showed that fuel injection equipment, bearings, gears, etc., were in excellent condition."

Get tremendous savings with low-cost heavy fuel oil—*purified by De Laval!* Write for details . . . today!

DE LAVAL SEPARATOR COMPANY

THE DE LAVAL SEPARATOR COMPANY Poughkeepsie, New York • 427 Randolph St., Chicago 6 • DE LAVAL PACIFIC CO. 201 E. Millbrae Ave., Millbrae, Calif.

Why 402 U. S. manufacturers now enjoy 100% tax

Governor Muñoz tells why Puerto Rico offers such amazing incentives to new or expanding manufacturers.

"IN THIS statement, I shall try to explain Puerto Rico's economic position as frankly as I would to any manufacturer or labor leader who met me face to face.

Puerto Rico is currently making a determined effort to stand squarely on its own economic feet. At present we do not have nearly enough jobs to support our people. We are therefore directing every energy to create more jobs at home, and to curtail migration to the States.

That is precisely why we are going all out to attract every *new* plant we possibly can. But, to date, we are still providing only 25% of the new jobs we need *each year* to keep pace with our expanding labor force. I shall go into details later. But first I want to make two points of my Government's policy absolutely clear:

> **1. Puerto Rico has no intention of winning industries *away* from anywhere. We do not grant tax concessions to *runaway* plants.**
>
> **2. Puerto Rico's Industrial Development Plan is based on a combination of absolutely ethical incentives. We do *not* and *never will* hold out low wages as an attraction to business. My Government's firm philosophy is that wages should rise as rapidly as our economic development permits.**

Let me now describe our basic problem in more detail."

Our Problem

"When people talk of over-population as Puerto Rico's biggest headache, they certainly don't exaggerate. Our unemployment is high. Our income level is still low—only 25% of the U. S. average. And every year 20,000 more workers swell our under-employed labor forces.

But this is probably putting the cart before the horse. Our real problem is not over-population but *under*-development. What then is our best solution?"

Our Solution

"I am convinced that the answer can only lie in more and more industry. Hence we are pinning our major hopes on our industrial development program, as the main pull of what we call Operation Bootstrap.

From the economic standpoint, Operation Bootstrap has but one simple aim—to develop industry, and in doing so, to encourage U. S. manufacturers to *expand* their operations to Puerto Rico. Operation Bootstrap is, in fact, a bold attempt to increase the well-being of our whole Commonwealth—workers and employers alike. And lest anyone should fear that my country's program might injure the U. S. economy, let me now sound a reassuring note:

> **1. The U. S. already has 65 *million* employed. Puerto Rico only needs to create 150 *thousand* new jobs to solve its present problem.**
>
> **2. One half of one percent of normal U. S. industrial *expansion* would achieve our whole economic program.**

I hope these comparisons help to put Puerto Rico's modest needs in proper perspective. But, for good measure, let me quote a few more figures to show how important a prosperous Puerto Rico is to U. S. business itself:

> **In 1955, Puerto Rico's purchases from the U. S. rose to $580,000,000. *Without* Puerto Rico as a customer, New York's gross sales would have dropped by $67,000,000; California's by $54,000,000; New England's by $53,000,000.**

So much for statistics. Now just a word about my people, without whose willing co-operation Operation Bootstrap would merely be a sterile dream."

Bootstrap Underway

"Pay us a visit and I think you will be impressed immediately by the wholehearted faith we Puerto Ricans place in Operation Bootstrap.

We believe in it deeply and thoroughly—and, with practically no exceptions, support its policies right along the line. Thus, I can promise the same eager, cheerful co-operation to every U. S. manufacturer who expands his industry to our Commonwealth.

Scarcely a month goes by that I am not visited by the Mayors of a dozen Puerto Rican towns, all asking for plants to be erected in *their* areas. There's not a community in all Puerto Rico that would not enthusiastically welcome the arrival of a new factory.

For we all realize that though we have made a promising start up the long, long hill to economic prosperity—the summit is not in sight yet. But the Puerto Rican people have squared up to their challenge and are meeting it in good heart."

in Puerto Rico freedom

Corporate Tax Exemption

If your net profit after U. S. Corporate Income Tax is:	Your net profit in Puerto Rico would be:
$ 29,500	$ 50,000
53,500	100,000
245,500	500,000
485,500	1,000,000

Dividend Tax Exemption*

If your income after U. S. Individual Income Tax is:	Your net income in Puerto Rico would be:
$ 7,760	$ 10,000
15,850	25,000
25,180	50,000
51,180	200,000

*Dividends are tax-free only if paid to residents of Puerto Rico by a tax-exempt corporation. Examples are based on Federal rates (Jan. 1, 1956) for single persons.

Beardsley Ruml tells how new or expanding industries (not runaway plants) get tax exemption.

"START A NEW plant in Puerto Rico and you are not only free from Federal income taxes (they don't apply)—you can be exempt from *local* income taxes too. Your freedom from Federal taxes is *not* a concession. It is a *Constitutional* fact which stems logically from that historic American principle 'Taxation without representation is tyranny.' Puerto Rico has no vote in Congress, and therefore no Federal income taxes—corporate or personal."

Protected by Two Constitutions

"Your business is not only protected by the Commonwealth Constitution, it is permanently guarded by all the guarantees of the U. S. Courts and Constitution, too.

As for your *local* income tax exemption, this is an *added* incentive, offered by the Commonwealth Government to attract new plants that Puerto Rico's economy needs so urgently."

How you gain from a new plant in Puerto Rico

1. A better return. Local tax concessions, freedom from Federal taxes, and lower operating costs will all reflect favorably in your company's balance sheet. See table above.

2. Abundant, skillful labor. Puerto Rico's labor force totals 644,000. The Commonwealth operates an ambitious vocational training program, which will even screen workers and teach them *specially* to operate your machines. The adeptness of the Puerto Rican worker in learning precision skills may be judged by the fact that the following famous companies now have operations in Puerto Rico:

Remington Rand. St. Regis Paper. Beaunit Mills. International Latex. Carborundum Company. Shoe Corporation of America. United Drill and Tool. Sunbeam Electric. Univis Lens. Weston Electrical Instrument Company.

3. No currency or customs problems. Puerto Rico is a Commonwealth freely associated with the United States. It is an integral part of the U. S. economic system. You have none of the problems of operating from a foreign country. Movement of goods, money and people between Puerto Rico and the U. S. is as free as it is between the states of the Union. There's no duty on trade and the U. S. dollar is currency.

4. Low capital investment. New single-story, low-rental factories are ready to occupy. The government will even build a *special* one for you on a very small down payment. Abundant electricity, gas and water are just waiting to be connected.

5. Ideal location. Puerto Rico is served by 30 ocean lines and 8 airlines. It is only 5½ hours by air from New York—less than 4 from Miami. Goods are actually made in Puerto Rico one day and are delivered in Los Angeles the next. The climate is perpetual Spring. Temperature stays around the balmy 70's most of the year. Swimming, sailing and fishing are superb. Domestic help is plentiful.

Is Your Company Eligible?

To find out if your company is eligible for tax exemption in Puerto Rico, call our nearest office:

New York.....MU 8-2960 .....579 5th Ave.
Chicago.....AN 3-4887 ...79 W. Monroe
Los Angeles ...WE 1-1225 ...5525 Wilshire

New booklet—free to manufacturers

Commonwealth of Puerto Rico
Economic Development Administration
579 Fifth Ave., New York 17, N. Y.
Dept. CE-61

Mail me "Facts for the Manufacturer," your report of the advantages of Puerto Rico for plant location.

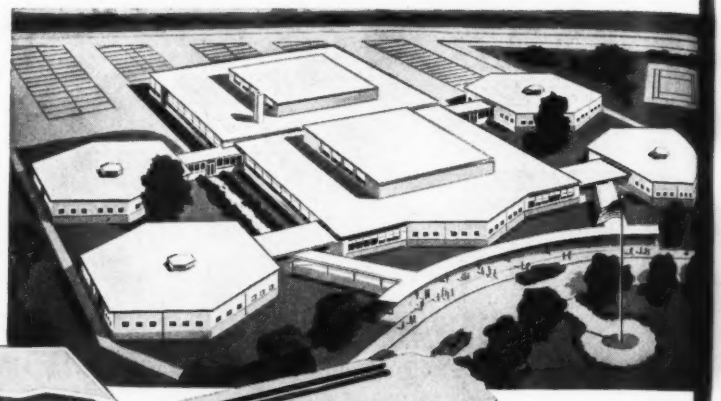
Name_____
Company_____
Product_____
Address_____

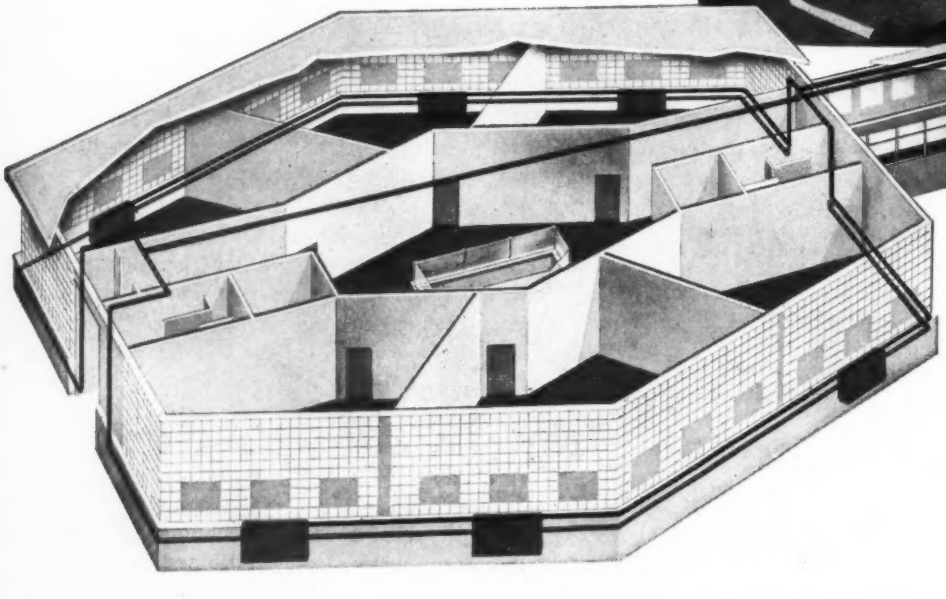
PROOF...

More Learning per School Dollar

through use of the Nesbitt Series Hot Water Wind·o·line System

This Nesbitt heating and ventilating system, with automatic temperature control, was installed in Lakewood High School at a cost of *$1.38 per square ft. of floor area!*





Lakewood High School, Lakewood, N. J.
Micklewright & Mountford, Architects
John Knecht, Mechanical Engineer
Maximum Capacity: 1000 pupils
Functional Capacity: 800 pupils
Gross Area: 86,240 square feet
Heating Contract: $118,787.00
Total Cost: $1,030,533.00

THE specification of the Nesbitt Series Wind-o-line System for Forced Hot Water Heating at Lakewood High School saved 2,400 feet of pipe trenches and 2,900 feet of additional mains and pipe covering when measured against a conventional steam system.

The Nesbitt Series Wind-o-line System effects these savings through the use of a unit ventilator radiator that delivers the required amounts of heat by multi-passing only one-third the usual amount of water—but at higher temperatures than is circulated by conventional hot water systems. This reduces the pipe size requirement to where the copper tubing of Wind-o-line Radiation can serve as the only supply and return piping for all the unit ventilators in an entire classroom wing, thus eliminating the need for mains, costly pipe trenches, coverings, and individual runouts to each unit.

Moreover, smaller water quantities mean smaller, less expensive pumps—with lower operating costs. And because the gravity heating effect of Wind-o-line Radiation and the Syncretizer radiator is sufficient to maintain overnight classroom temperatures, the cost of additional controls and equipment for that purpose is eliminated.

The Nesbitt Series Wind-o-line System means *greater comfort,* too! Since the system water temperature is varied by outdoor temperature, Wind-o-line's protection against cold surfaces and window downdrafts is continuously related to actual needs — helping to create the thermal environment most conducive to learning.

Nesbitt Heating and Ventilating offers you
MORE LEARNING PER SCHOOL DOLLAR
Write for further information

Nesbitt

SERIES WIND·O·LINE SYSTEM

Manufactured and sold by John J. Nesbitt, Inc., Philadelphia 36, Pa. **Sold also by American Blower Corporation and Canadian Sirocco Co., Ltd.**

The Reader's Guide

Added Insult to Injury

Consulting engineers seem to be very much interested in their relations with the law. Albert Woodruff Gray, a lawyer who has been writing for this magazine for many months, offers in this issue a review of some legal tangles that consulting engineers have had with the wage and hour provisions of the Fair Labor Standards Act. This article reviews several recent cases in which the decisions have depended upon the court's opinion as to whether or not consulting engineers are in interstate commerce. It is interesting to note that in every recent case the District Court has decided in favor of the consulting engineer and then this decision has been reversed in the Court of Appeals. The United States Supreme Court has either upheld the Court of Appeals or refused to review the case, leaving the engineer stuck with the wage and hour provisions. Where the article by Gray presents the history of these cases and quotes from the decisions, "Scraps & Shavings" this month pleads the case of the consulting engineer and suggests the need for legislation to clear the matter up. Subjecting the engineer to these regulations while exempting other professional men is an insulting piece of business.

Conditions Could Be Worse

Anyone who tends to become upset over the low state of professional ethics among U. S. consulting engineers may feel better after reading "Report from India" in this issue. Those poor devils seem to be on the very bottom of the heap. The conditions under which they are forced to operate makes an occasional commission check to a member of a Ways and Means Committee look no worse than a childish peek beneath the blindfold in a game of Pin the Tail on the Donkey.

A Matter of Choice

Last month we conducted a survey among a small sample of our readers in an effort to determine which features of this magazine are best read. While the returns are incomplete at this time, and it would be dangerous to try to reach definite conclusions on the basis of such a partial sample, it is surprising to note the different types of readers CONSULTING ENGINEER has on its circulation list. There seems to be a small but identifiable group who read almost all of the ads but very little of the editorial section of the magazine. This type of reader brings a sparkle to the eye of our advertising department, but the editorial face wears a frown when the data on such an individual is entered into the tabulations. At the other extreme there are those engineers who refuse to look at an advertising page but devour the departments and feature articles greedily. Fortunately, most readers seem to be a bit more selective and read some of the ads and some of the editorial material. Even these men, however, group themselves in seemingly strange ways. Some readers seem to prefer regular departments and avoid the feature articles, while others reverse this and read the feature articles but avoid the regular monthly departments. All of this probably means nothing more than that consulting engineers differ as much in their reading tastes as in their selections from a restaurant menu.

In Lieu of a Raise

A couple of weeks ago in the Southwest we ran into a particularly enthusiastic reader. Naturally, we enjoyed listening to all the nice things he had to say about CONSULTING ENGINEER. This man has a medium size office with about ten registered engineers in his employ. We noted that he was getting only one copy of the magazine in the office and offered to send additional copies for his top employees. He rocked us a bit with his reaction to that suggestion. "No, no, don't send any more copies here to the office than the one I am now getting. This way I have complete control of the copy we get and I let only those read it who have done a particularly good job during the month."

Scraps & Shavings

THERE SEEMS TO BE some sort of mental blockage in the legal mind that finds it impossible to concede that professional status can be achieved by anyone who has not studied the law. Medicine, in some of its branches, they admit, has certain aspects of professionalism; and they accept theology as perhaps professional at some time in the past. The engineer, however, is rarely recognized as professional, and he must prove himself.

This aversion of the lawyer to admit others to professional status can become irritating — and insulting. A good example is in the administration and interpreting of the Wage and Hour Provisions of the Fair Labor Standards Act. During the past few years almost every engineering office of any size has been hounded by government administrative employees who spend hours of their time and the time of the principals and employees of the firm trying to determine whether the employees are being paid properly for their overtime work. Despite the high pay levels of employees of engineers in private practice, there is usually some minor settlement to be made, often based upon the manner in which the payment was made rather than the amount of the compensation. More time and money is wasted in making and keeping the books and records required by the investigators.

Records show that if the consultant decides to take the case to court, he is almost certain to win the case in the District Court and then have that decision reversed in the Court of Appeals and the Supreme Court.

These administrative investigators operate on the assumption that there are two classes of employees in a consulting engineer's office, professional and non-professional. Registered engineers who make over $75.00 a week are considered professional, while draftsmen or clerical workers come under the Act. This same method of separation is used for industrial concerns who employ engineers. But, "professional" operations such as law offices, medical offices, and even architectural offices are treated in quite a different way. They offer professional services and therefore their employees do not come under the Act whether the business carried on is intra- or inter-state in nature. This is a most insidious insult to the engineer in private practice. Why should a consulting engineer who offers nothing but services to his client be treated as unprofessional to the extent that his employee's wages are investigated as though he were the producer of goods in interstate commerce — as though he were a manufacturer rather than a professional practitioner of engineering.

It is likely that the insult is not intentional but comes about through stupidity. The members of the bar — and particularly the more learned of their cast who have been seated on the bench — are abject idiots when it comes to knowledge of the practice of engineering. Lawyers, in general, take personal pride in their lack of mathematical or scientific aptitude, and they have no concept of the type or extent of the services offered by the consulting engineer in private practice.

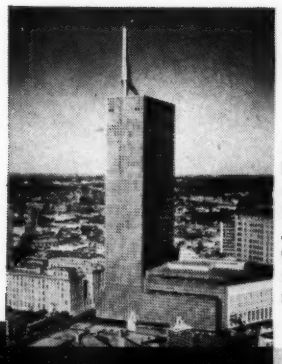
The idea that an architectural firm designing one portion of an industrial building is a professional firm while the consulting engineer firm designing another part of the same building is in interstate commerce shows how little the lawyer knows about the work of an engineer in private practice.

The records of cases brought against consulting engineers indicate that there is not much hope for intelligent interpretation by the courts. Defining legislation is needed.

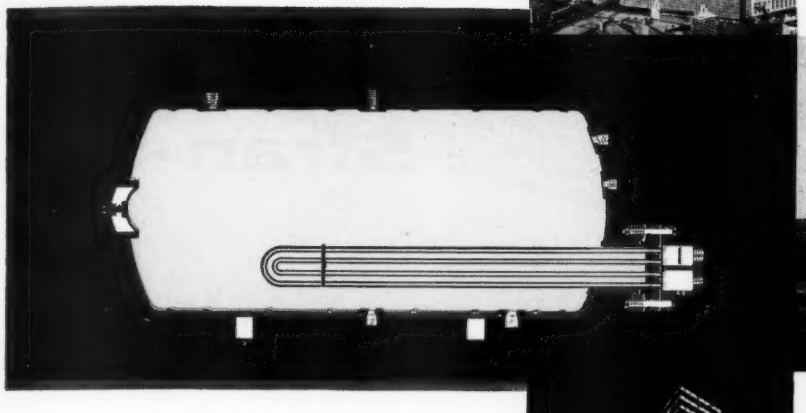
Though most congressmen are not going to get any awards for distinguished scientific achievement, and while most of them have been trained in the law, they do seem to have a better understanding of the professional character of the work of the engineer in private practice than do the practicing members of the bar and the bench.

The only logical way to approach this problem is to go to Congress with it and have the Fair Labor Standards Act amplified in its definition of "professional" to such an extent that it becomes clear to even the judges of the highest courts that consulting engineers offering only services to their clients are not thereby operating manufacturing concerns whose products are in interstate commerce.

It is true that this law has been interpreted broadly and that coverage has been extended to the fringes of anything Congress could have had in mind, but to bring the consulting engineer in private practice under the act is stretching the logic of even the legal mind too far.



Dallas: Republic National Bank Building. *Architects:* Harrison & Abramovitz; Gill & Harrell. *General Contractor:* J. W. Bateson Company, Inc. *Consulting Engineers:* Jaros, Baum & Bolles. *Mech. Contractor:* Farwell Company, Inc.



Denver: Mile High Center. *Architects:* I. M. Pei and Associates. *Associated Architect:* G. Meredith Musick. *Contractor:* George A. Fuller Company. *Consulting Engineers:* Jaros, Baum & Bolles. *Mechanical Contractor:* Kerby Saunders, Inc.

New York: Lever House. *Architects:* Skidmore, Owings & Merrill. *Contractor:* George A. Fuller Company. *Consulting Engineers:* Jaros, Baum & Bolles. *Mechanical Contractor:* Kerby Saunders, Inc. *Plumbing Contractor:* Gillman-Rous-Pesce Corp.

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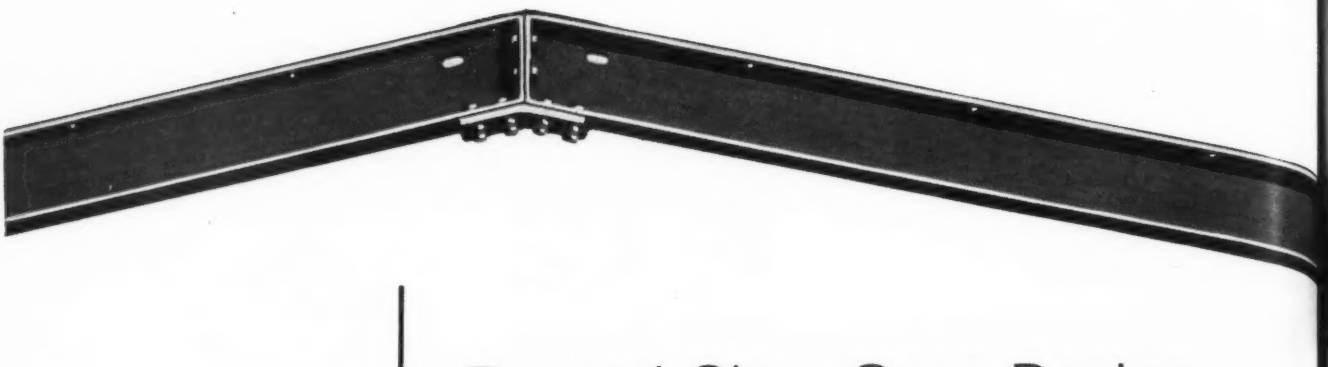

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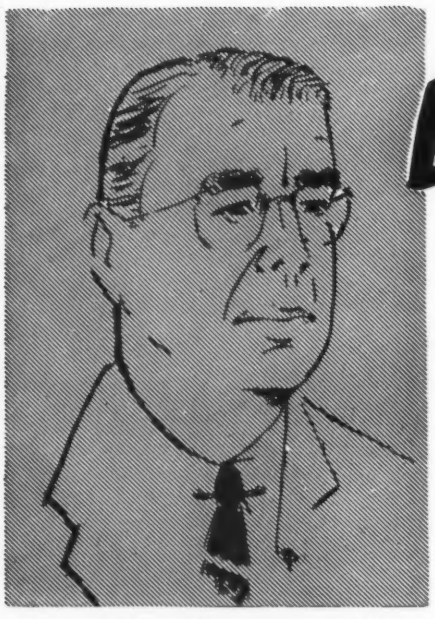


Economic News Notes

E. F. MacDonald
INDUSTRIAL ECONOMIST

1ST OF THE SEASON — This is open-season on business forecasts. One of the earliest "bagged" was by Mr. S. Edmunds, manager of economic studies for Ford. Optimistic on the basis of a "sharp expansion in consumer spending and business activity" this 4th quarter, Mr. Edmunds foresees a 4.5% rise next year in total output of the nation.

NO COMPETITION — Roads built under the new $33 billion Federal highway construction program will not divert traffic from state-built toll roads. To the contrary, adds Mr. L. L. Rothschild, Under-Sec. of Commerce for Transportation, they may actually increase the latter's traffic. To allay fears on this score, he states, "There is no intention whatever of building any routes paralleling a toll road which until 1975 will adequately serve the traffic needs of the area through which it runs."

MOONPOWER — A 2300 ft hollow dam across the Rance River near the Brittany coast in northwest France will be started next spring. Its two-way turbines will be actuated by tidal ebb and flow. As reported in the Wall Street Journal, the French claim to have worked out a new technique for harnessing the tides and at a cost that will compare favorably with French coal power generation.

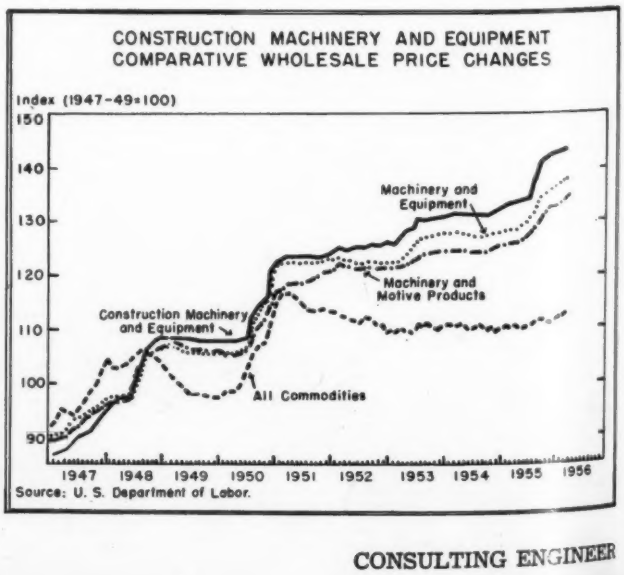
CONSTRUCTION STIMULUS — At this writing, Kaiser is the latest steel company to apply for tax assistance on expansion projects. This brings to $846 million the total applications filed in recent weeks by six steel makers for Government permission to apply rapid amortization schedules to planned productive facilities. At present steel making is not one of some 30 expansion goals open for rapid write-offs.

UNDER WAY — President Eisenhower's first progress report on the new highway construction program discloses that in the first five weeks the Bureau of Public Roads approved state plans for bid requests on 122 miles of roads estimated to cost over $36 million. Contracts amounting to $18 million were awarded during the period for 110 miles of roads previously approved.

WATERFRONT CONSTRUCTION — An engineering study of the Port of Philadelphia by James C. Bulkley, Inc. recommends outlays of $60 million to rehabilitate and expand Philly's shipping facilities. It is felt that an aggressive waterfront program will be necessary to offset advantages accruing to Great Lakes ports from the St. Lawrence Seaway. Significantly, Congress recently appropriated an initial $6 million for expenditure this fiscal year in dredging the Delaware River to permit passage of ocean-going shipping.

NOT LAST! — The Washington State Education Association polled some 800 persons to find out how teachers rated in the community. The majority put them at the top of the list as most important to the community — with clergymen, public officials, engineers, and lawyers following in that order.

RISING COSTS—The late steel strike and its aftermath make pertinent a look at the record of prices of construction machinery and equipment. During the period shown on the chart, such prices rose 66%—well in excess of increases of 50% for the machinery and motive products group and 53% for all machinery and equipment. It is this sort of upward pressure on costs, which is growing stronger, that gives rise to record levels of failures of contractors.



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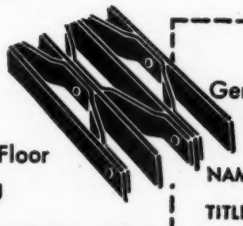

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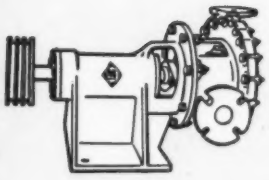
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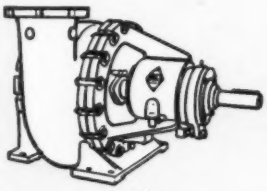
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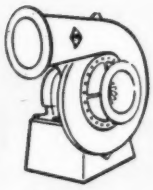
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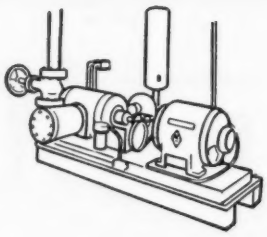
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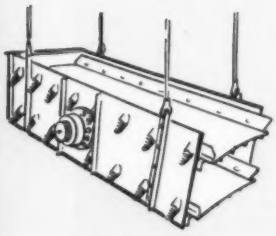
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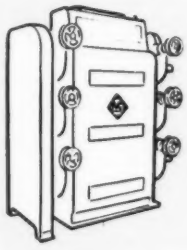
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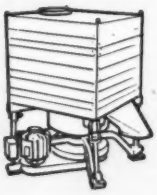
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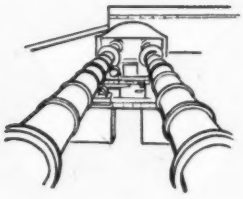
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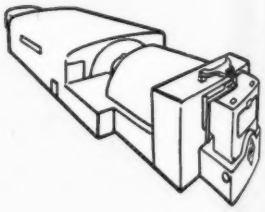
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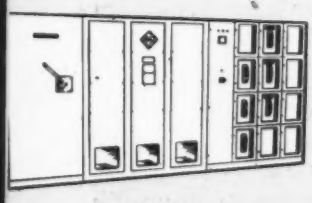
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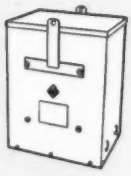
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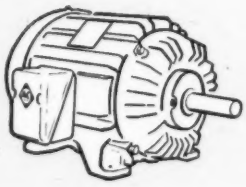
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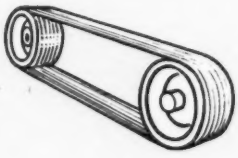
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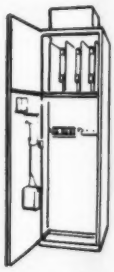
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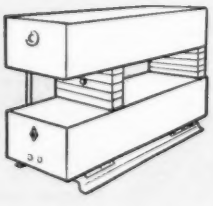
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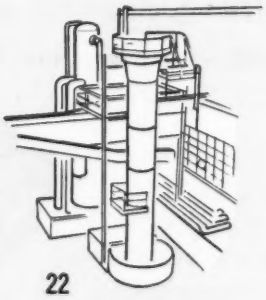
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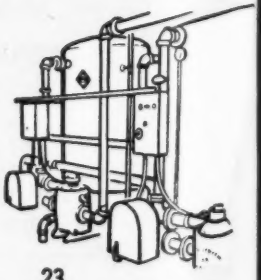
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Send for Bulletin 25C6177, covering all Allis-Chalmers equipment for the process industries. This bulletin as well as literature covering specific equipment lines is yours for the asking. Write Allis-Chalmers, Milwaukee 1, Wisconsin.

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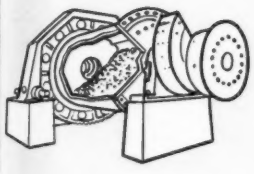

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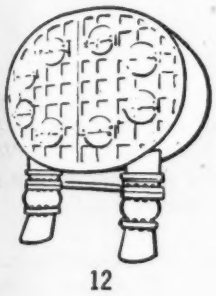

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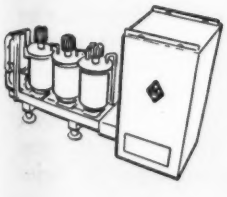

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There's No Guesswork

Allis-Chalmers offers the consulting engineer all the help he *wants or needs.* In working with consultants, your A-C representative uses the technical skill and experience of the many Allis-Chalmers engineering departments. Their recommendations are backed by research, by testing and pilot plant facilities, by experience gained in solving many thousands of equipment application and coordination problems.

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Because Allis-Chalmers builds many types and sizes in a given equipment line, recommendations are dictated only by specific requirements.

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The "plus" you get is the Allis-Chalmers approach to equipment application. It's called "*coordineering.*" As manufacturers of the most diversified line of processing and electrical equipment, A-C maintains separate departments for each product—each staffed with specialists. "Coordineering" results from an interdepartmental exchange of ideas and of thinking, planning and engineering that precedes the integration of equipment.

Answer... ALLIS-CHALMERS

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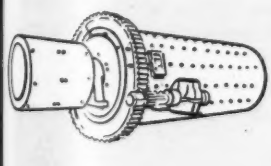

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How many DID you identify?

1. Process Pump; 2. Solids Handling Pump; 3. Centrifugal Blower; 4. Rotary Compressor; 5. Gyratory Crusher; 6. Grinding Mill; 7. Vibrating Screen; 8. Roller Mill; 9. Gyratory Screen; 10. Rotary Kiln; 11. Turbine Generator; 12. Condenser; 13. Unit Substation; 14. Dry-Type Transformer; 15. Explosion-Proof Motor; 16. V-belt Drive; 17. Motor Control; 18. Mercury Arc Rectifier; 19. Dielectric Heater; 20. Manlift; 21. Metal Detector; 22. Continuous Contact Column. 23. Water Conditioning Equipment; 24. Blade Washer

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ATOMS IN ACTION

THE STATE of the U. S. reactor art was summed up by Deputy Director Louis H. Roddis of the AEC Reactor Development Division in a speech before the Ohio Conference on Peacetime Uses of Atomic Energy and Radiation Safety. He listed 109 research and civilian reactors as built, being built, planned, or under consideration. Included were 10 reactors that had been built and dismantled; 29 in operation; 19 under construction; 46 planned; and 5 proposed but still under consideration. Of the power demonstration plants, one is in advanced stages of construction; ground has been broken for two; construction permits have been issued for two; AEC has signed a contract for one; four are approved for contract negotiations; and five are under consideration.

GENERAL ELECTRIC is producing experimentally plastic parts from Vulkene 107-E, a product vulcanized by irradiation and reinforced by carbon-black. As compared with conventional high pressure polyethylene, Vulkene's yield strength at low temperatures is double and its creep deformation reduced to 10 percent of that for polyethylene. Excellent heat stability, chemical resistance, and elimination of stress corrosion cracking are claimed for the product. The British firm, Dunlop Rubber Co., has set up a laboratory at Birmingham, England, specifically designed for work on irradiation of rubber and plastics. Initial experiments are being conducted with a 100-curie source of cobalt-60. A 1000-curie source is planned for the future with the possible addition of an electron accelerator.

NUCLEAR ENERGY PROPERTY Insurance Association, organized last May to provide up to $50 million in property damage coverage, also will handle builder's risk insurance on nuclear installations after nuclear hazards have been introduced. Operations of NEPIA are under direction of the Factory Insurance Association. FIA engineering and inspection facilities will be used.

DUPONT plans to build a $2 million radiation physics laboratory at its Wilmington, Del., experimental station for long-range research on measurement of radiation and its absorption in various materials. The firm has indicated that its primary interest is now in the effect of radiation on reactions involved in chemical manufacture rather than in the reactor power field.

HYDRAULIC APPLICATIONS in the design and operation of nuclear reactors will be discussed by three atomic energy specialists at the 12th Annual National Conference on Industrial Hydraulics to be held in Chicago, October 18 and 19. Dr. Richard F. Humphreys, who was instrumental in initiating the research reactor program at Armour Research Foundation, will speak on "Reactor Principles and Types." The 250,000 kw Consolidated Edison atomic power plant being designed by Babcock & Wilcox will be described by Frank R. Ward, of B & W. Stuart McLain, program coordinator at Argonne National Laboratory, will discuss "Reactors of the Future."

THE NUMBER OF INDUSTRIAL users of radioactive isotopes has increased more than 500 percent in the past five years, according to a survey by the Atomic Industrial Forum. Research, development, and testing organizations account for the largest number of user organizations, with manufacturers of electrical equipment, electronics, and instrumentation, and the metal working industry next in order. AEC has estimated that use of radioisotopes is saving industry some $200 million yearly. The Atomic Energy Guideletter has recently published a book, "Radioisotopes—the Wonder Tool," that covers the uses, techniques, and applications of radioisotopes to industrial and other processes.

AEC HAS APPROVED negotiation of a contract for limited initial design and development work on the 10,000 kw power reactor proposed by Chugach Electric Association, of Anchorage, Alaska, and Nuclear Development Corp. of America, White Plains, N. Y. The Commission also authorized negotiation of contract provisions making it possible to proceed with plans for final development and engineering design, provided results of initial phases are acceptable. The reactor will use heavy water as moderator, liquid sodium as coolant, and slightly enriched uranium as fuel. The proposed Anchorage plant brings to three the number of proposals AEC has approved under the second phase of its Power Reactor Program. Four more proposals are still under consideration.

MASSACHUSETTS Institute of Technology has received a $250,000 grant from Rockefeller Foundation for medical and biological facilities to be used with MIT's research reactor. This is in addition to the $500,000 from the National Science Foundation for construction of the reactor. A therapy room, equipped for operating, will be located directly under the reactor so that a stream of neutrons can be beamed directly on the patient through an opening in the ceiling.

ATOMIC ENERGY OF CANADA, LTD., the Canadian equivalent of the U. S. Atomic Energy Commission, has awarded AMF Atomics, Ltd. the first long-term contract to fabricate fuel elements. AMF Atomics, the first private company in Canada to be organized solely for nuclear research, development, and engineering, will build a 30,000 sq ft plant near Port Hope, Ontario as the first unit of a large nuclear facility.

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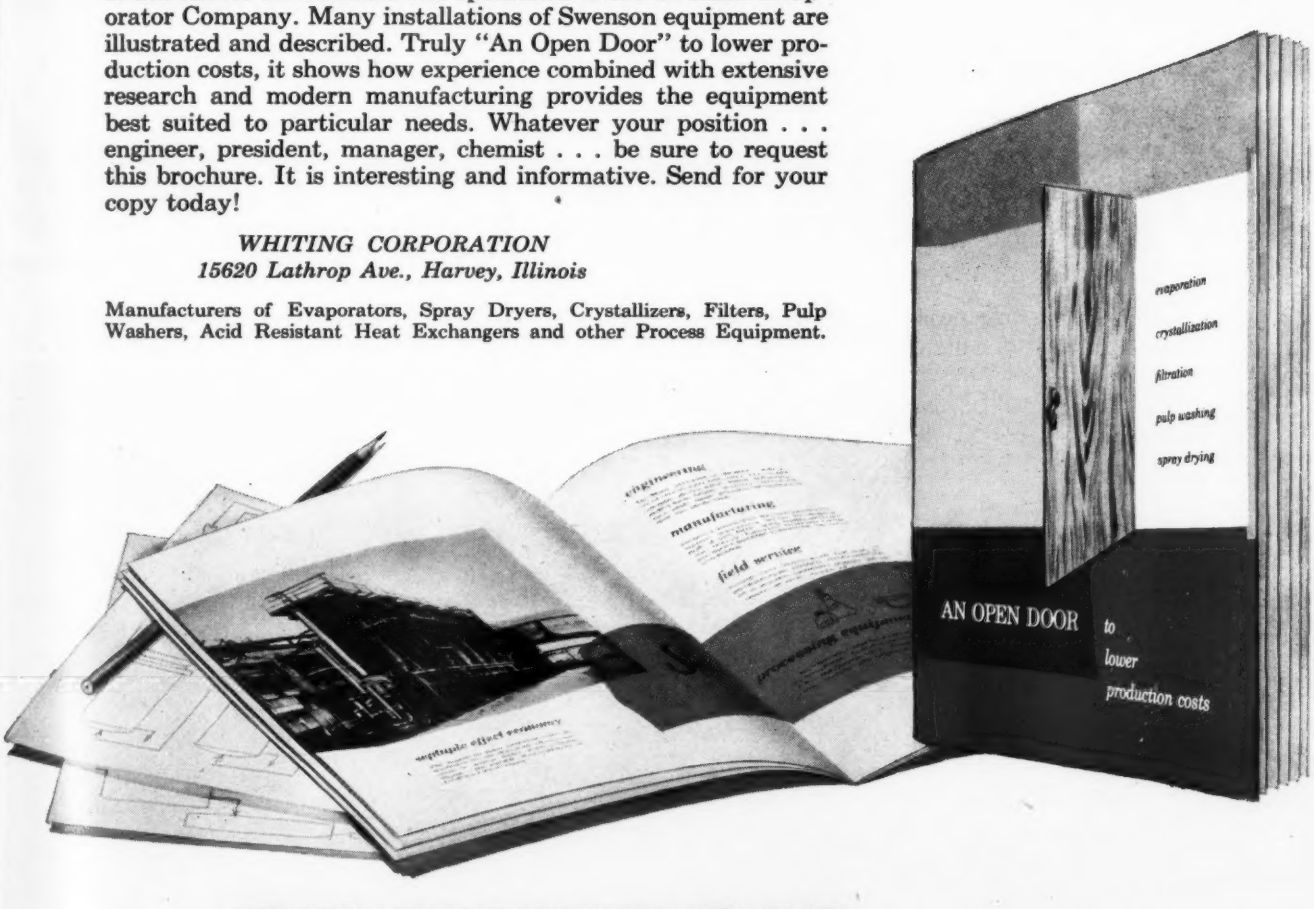

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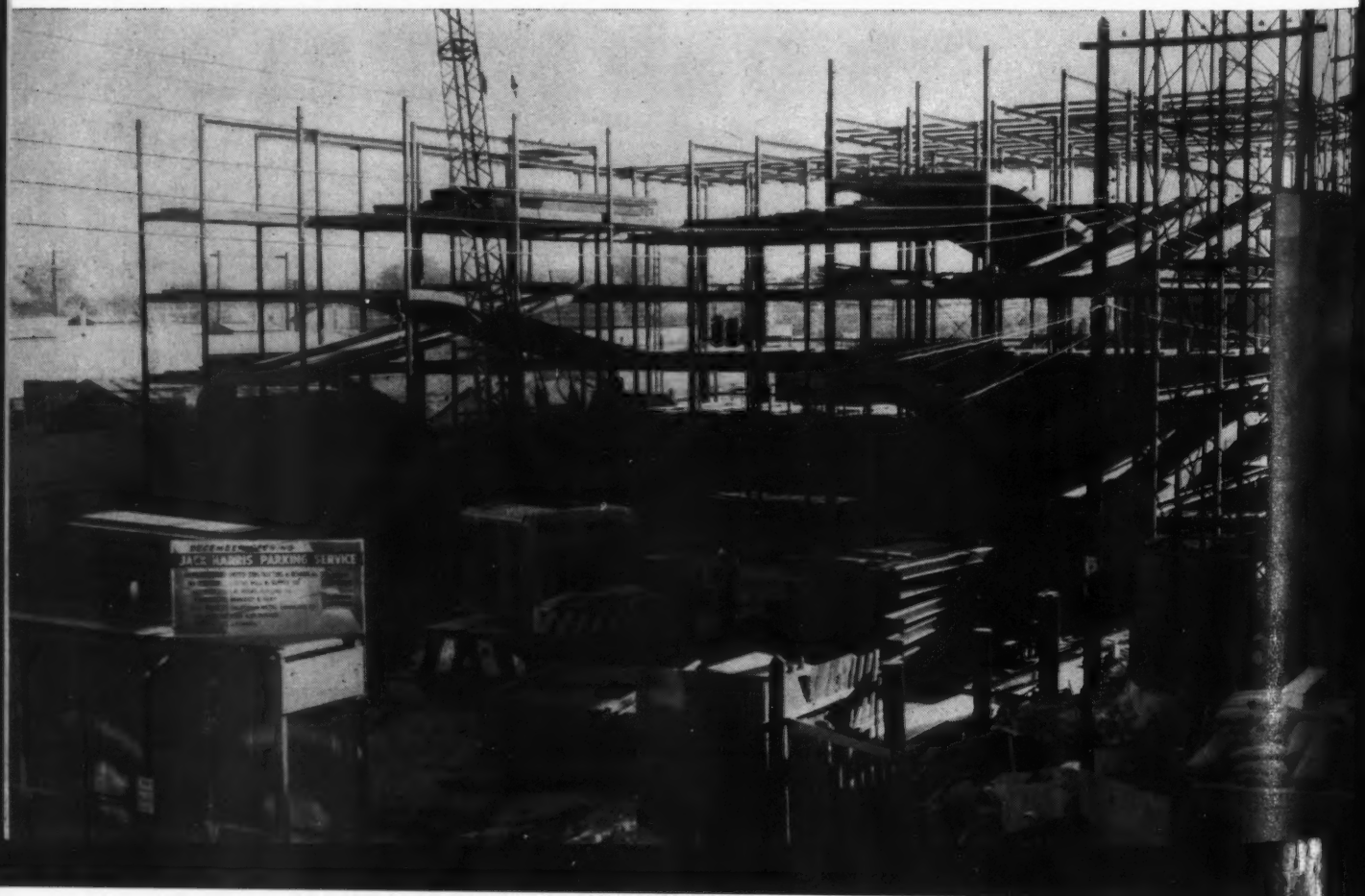

INTERIOR. Ramps are surfaced with expanded steel grids for better traction.

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d money in Las Vegas

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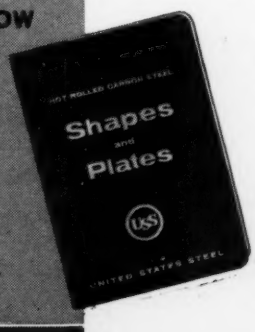

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The Legal Aspect

MELVIN NORD, P.E.
Consultant in Legal and Technical Problems
Patent Attorney

Engineering Registration (III)

IN ADDITION to nonresidents practicing temporarily within a state, other engineers may be exempted from registration if they meet certain classifications. The general requirement of the statute is that all persons practicing or offering to practice the profession of engineering, or using a title conveying the impression that they are professional engineers, must be registered or exempted.

Exemption Provisions

Although there is considerable variation in the exemption provisions from state to state, the following generally are provided:

Employees of Registered Engineers

Employees or subordinates of registered engineers need not be registered even though their work is engineering in nature, unless it includes responsible charge of design or supervision. This provision makes it possible for a person to acquire the necessary experience before becoming registered.

Government Employees

Officers and employees of the United States Government or its agencies are exempted, since the state has no power to regulate the qualifications of an employee of the Federal government.

Railroad and Utility Employees

Employees of railroads, of public utilities subject to regulation by the state Public Service Commission, or of corporations engaged in interstate commerce are exempted. Exemptions of this type have been criticized, because they provide arbitrary discrimination and thus violate the "equal protection of the laws" clause of the Constitution. The purpose apparently is to avoid conflict with other state laws in some instances, or with the prerogatives of the Federal Government in others. However, the fact that the Federal Government has plenary power to regulate interstate commerce does not mean that it would be improper for a state to require engineers employed by corporations engaged in interstate commerce to be registered, since Congress has not preempted this field. It seems likely that this exemption is illegal, and if so, it may render the entire statute unconstitutional, since it deprives the nonexempt engineers of "equal protection of the laws." In fact, it has been so held in Commonwealth v. Humphrey, 288 Pa. 280 (1927). The Pennsylvania statute was thereafter re-enacted without this objectionable provision. Nevertheless, it still appears in the statutes of many other states.

Engineering by an Owner

Engineering practice by an owner (whether individual, firm, or corporation) on its own land, where public health or safety are not affected, is exempt from registration. This distinction is valid, but it is broad and indistinct when it is applied to large corporations, since it is not always clear beforehand whether or not the public will be affected.

Employees of Manufacturers

A similar exemption frequently is given to employees of manufacturing companies, where the manufacturer of the articles assumes responsibility.

Engineering on Private Residences

Engineering work in connection with the construction of private residences not exceeding specified sizes frequently is exempted.

Corporations and Partnerships

In most states, the statute expressly permits the practice of engineering by corporations, partner-

ships, or other firms, provided "all partners, officers, and directors" are registered. In some instances, the restriction is less severe. If the restriction is simply that the person or persons in responsible charge of engineering work must be registered engineers, this makes a great deal of sense. If the restriction goes beyond this, however, it is questionable whether it is justified.

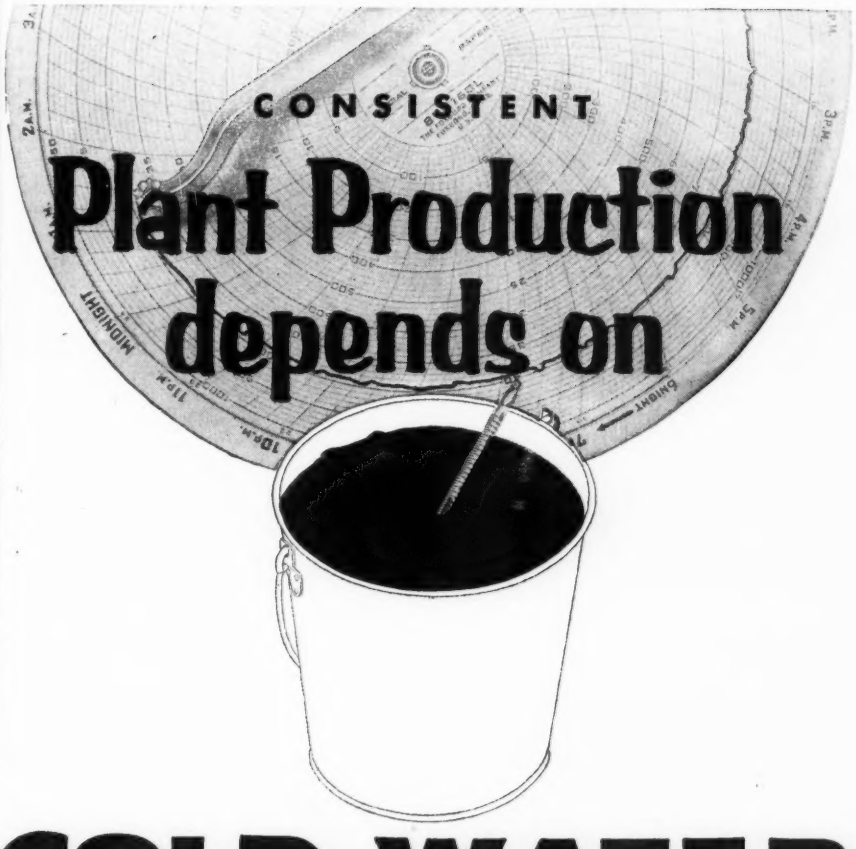
"Legal Person" Question

The difficulty could be cleared up immediately if it were recognized that though corporations or firms may contract to "supply engineering services," actually the engineering work can only be done by "persons having knowledge of the principles of engineering." There is no reason to be confused by the metaphysical notion that a corporation is a "legal person." This is used primarily as an aid in analysis of legal problems relating to the legal capacity of a firm to sue and be sued in its own name and to own property in its own name, and has no relevance to the question of the practice of engineering.

Basis of Restrictions

Restrictions on the practice of engineering by firms are probably based on an analogy to other professions, such as law and medicine. In these professions corporate practice is prohibited altogether because of the confidential relationship between the professional man and his client. The relation between engineer and client is not, in general, of such a confidential nature as to justify the analogy. Furthermore, engineering practice differs from legal or medical practice in that substantial organizations and investment of capital frequently are required. The fact that engineering is a profession does not imply that it is closely analogous to law or medicine in all respects. It is a profession, but a different kind of profession from law or medicine.

It is improper to restrict engi-



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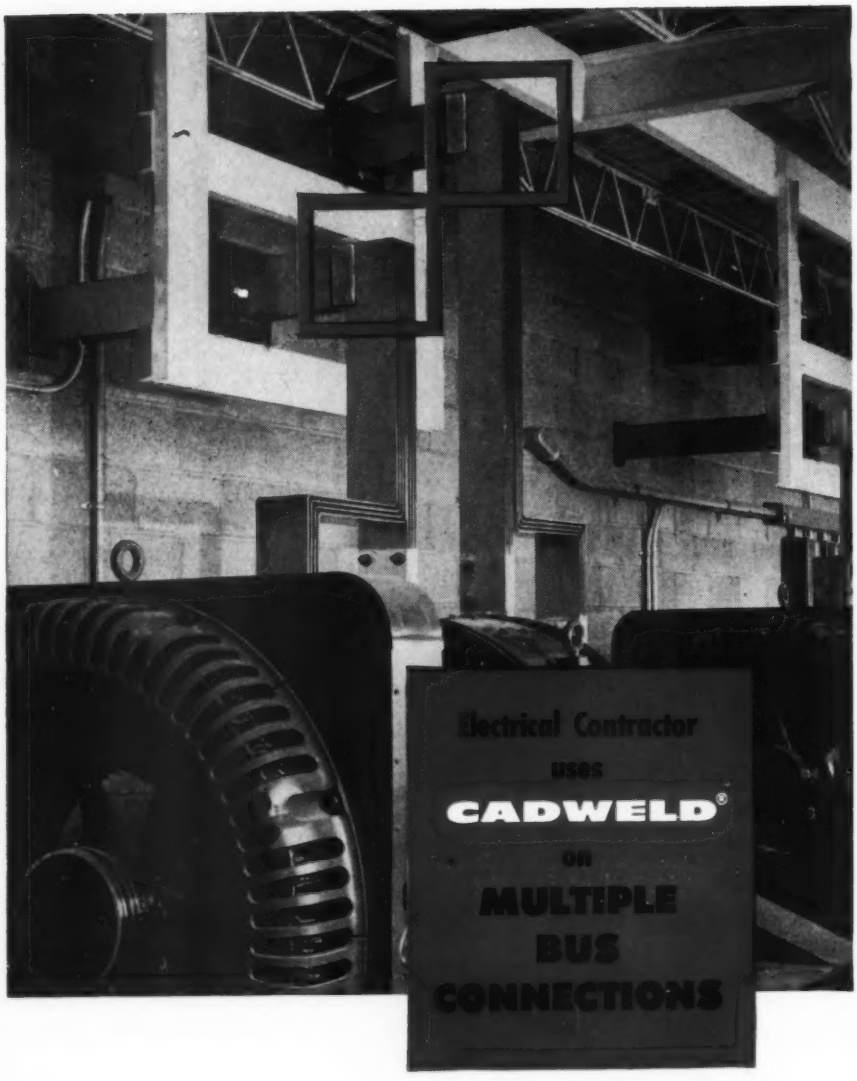

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neering practice on the basis of an unjustified analogy. Sufficient protection to the public can be provided by seeing through the corporate or other firm structure to the people who actually are doing the engineering work.

Registration by Branch

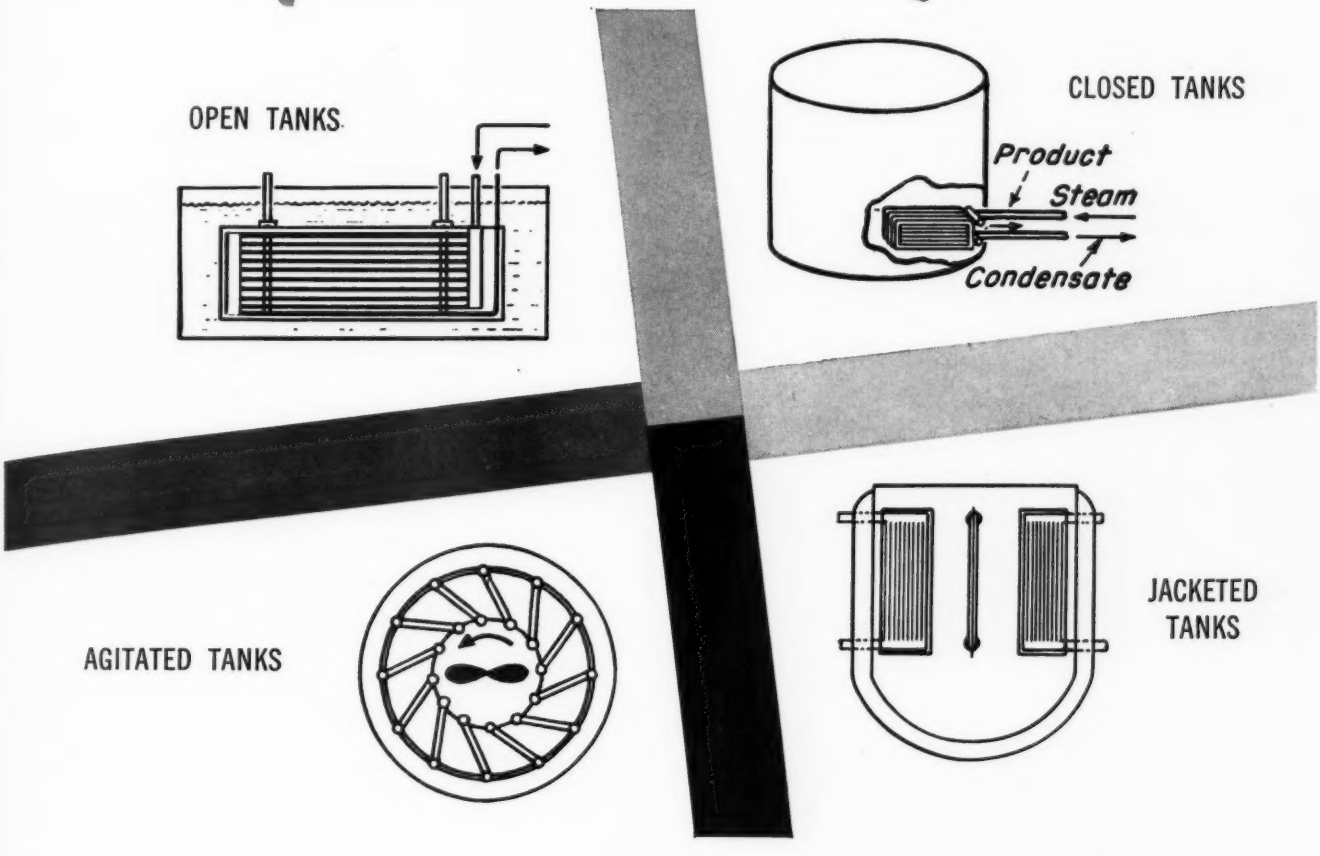
Most statutes are silent as to registration in specified branches of engineering. In most states, the statute provides only for registration as a professional engineer. In some of these states, the Board has arbitrarily designated a specific branch (e.g. Chemical Engineering) on the engineering registration certificate. This practice has been held to be illegal in Prouty v. Heron, 127 Colo. 168 (1953), since no definitions were given by the legislature with regard to these branches, and the Board had no power to "declare what the law is." It should be possible to avoid this difficulty by careful drafting of the statute, either specifically providing for registration in the branches of engineering the statute is to cover or specifically providing for registration of engineers in all branches. Either of these alternates would be legally acceptable.

Engineer-in-Training

In half the jurisdictions, enrollment of engineers-in-training is provided for explicitly. To be enrolled as such, a person must be a graduate of an accredited engineering college or have a specified number of years of engineering experience (generally four), and must pass a written examination. There is no legal significance to enrollment as an engineer-in-training, except that it signifies that the person in question has completed a portion of the requirements and, upon completion of an additional number of years of experience, will be registered without being required to take an examination in academic subjects.

In some states, engineer-in-training enrollment has been inaugurated by the Board without express authorization in the stat-

in any corner of the plant...



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Standard Platecoil units solve most problems, but special units (curved, embossed on one side only, special finishes) can be obtained on special order. Cold rolled and stainless steel units are available from stock, and on special order, units can be made from Carpenter 20, Monel, Hastelloy B, Hastelloy C and Nickel.

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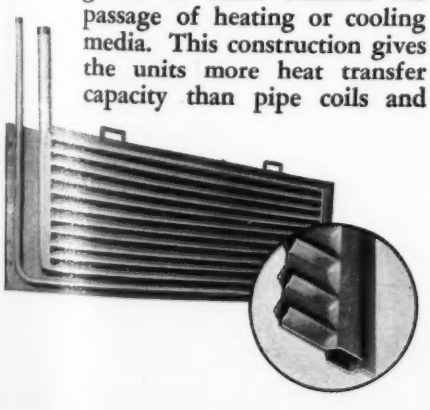

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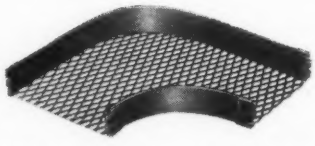

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ute. This should certainly be within the rule-making power of the Registration Board.

Public Works

About two-thirds of the states have provisions requiring that engineering services on public works be performed by registered engineers, or prohibiting payment of public funds for engineering services performed by nonregistered engineers. This provision is of course of great importance to persons performing engineering services for state or municipal governments.

Penalties

A person who is required to be registered and who fails to do so may be subjected to a variety of penalties.

Generally, it is provided that violation of the statute is a misdemeanor, for which a fine of $10 to $1000 may be imposed, as well as imprisonment for ninety days.

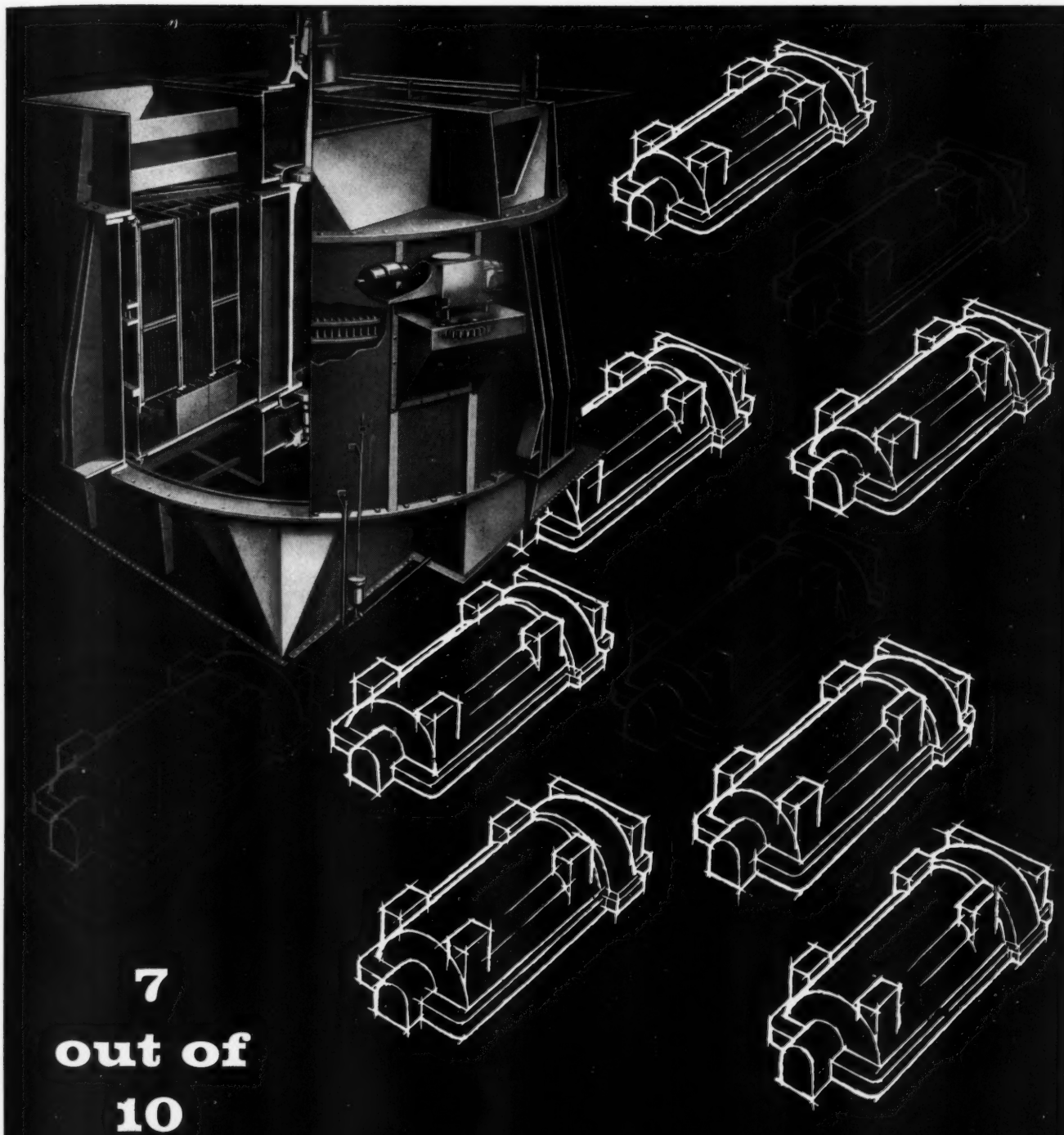
In addition, engineering contracts entered into by a person violating the statute are illegal and cannot be enforced by him.

When a nonregistered engineer attempts to testify as an expert witness, the court may refuse to permit him to do so on the ground that he is not properly qualified.

In a few states, the Board can obtain an injunction preventing an engineer from violating the statute. This a powerful weapon, generally granted by legislatures to administrative agencies, and should be made a part of all engineering registration laws. ▲▲

Expert Witness Reprint

Robin Beach's five articles on "The Engineer as an Expert Witness" are available in a 16-page reprint for $1.00. Please write to: Reader Service Dept., CONSULTING ENGINEER 227 Wayne St., St. Joseph, Mich.



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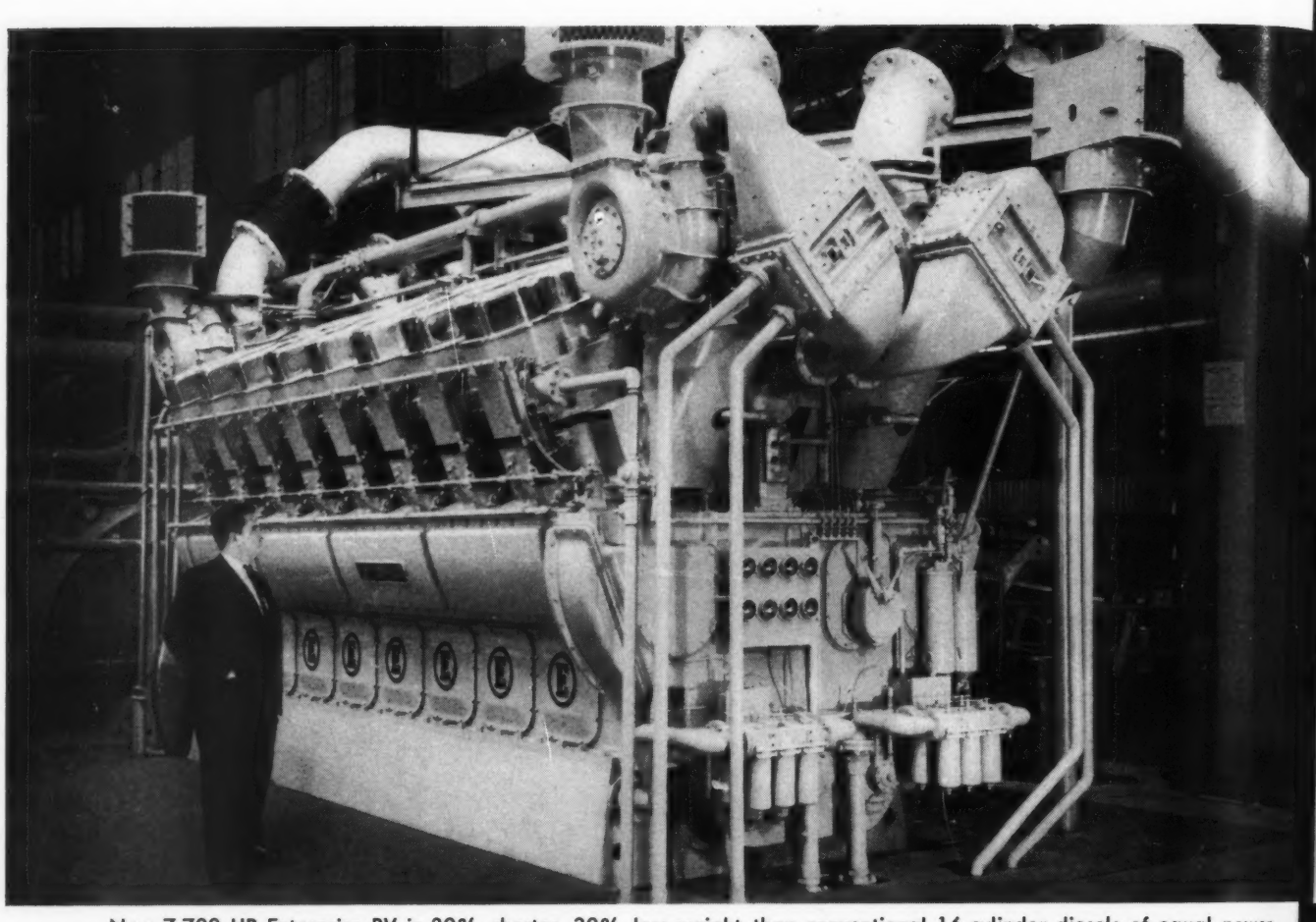
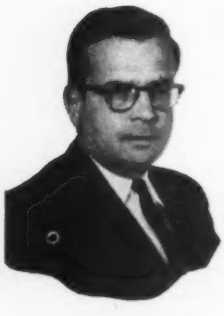


New 7,700 HP Enterprise RV is 20% shorter, 30% less weight than conventional 16-cylinder diesels of equal power.



Enterprise announces the new 16-cylinder RV diesel —World's smallest 7,700 HP engine

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Here at last is a turbocharged V-type, heavy-duty engine specifically developed to produce *more* horsepower in a *smaller* unit —dependably and continuously.

For marine installations this means more payload space, greater tonnage capacity than ever before. For electric power generation in municipal or industrial plants, and as power for pumping oil, gas or water, the reduced costs of foundations, installation, operation and maintenance make the RV even more attractive to engineers and owners.

Diesel, dual fuel, tri-fuel, spark ignition

The RV can be operated as a diesel, dual fuel, tri-fuel, or spark ignited gas engine. Its low operating costs on diesel fuel can be cut even further when residual fuels are used. This is "workhorse" power at its dependable best. Thousands of continuous, uninterrupted hours without shutdown are characteristic of the RV's slow-speed operation.

Less bulk makes installation easier, servicing simpler. RV maintenance doesn't require major disassembly, either. All working parts are accessible for service from the outside. So overhaul costs are kept low and downtime is reduced to an insignificant factor.

Vital statistics of Enterprise RV:

Type: 4-cycle, 12 or 16 cylinders, 17" bore by 21" stroke

Rating: To 7,700 BHP at 400 rpm. Piston speed: 700-1,400 fpm.

Dimensions: 26'4" long, 9'4" wide, 12'1" high

Weight: (less flywheel) 189,100 lb.

Fuel: Diesel, dual fuel, tri-fuel, spark ignited gas

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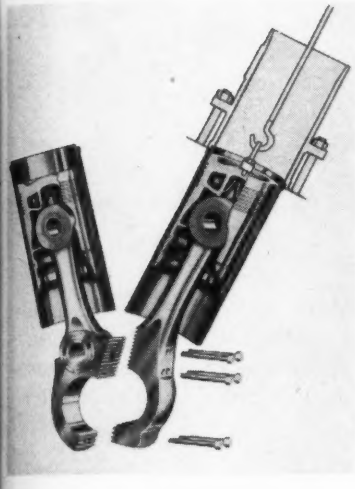
How the exclusive Enterprise turbocharged V-block design packs more heavy-duty horsepower into less space, less weight

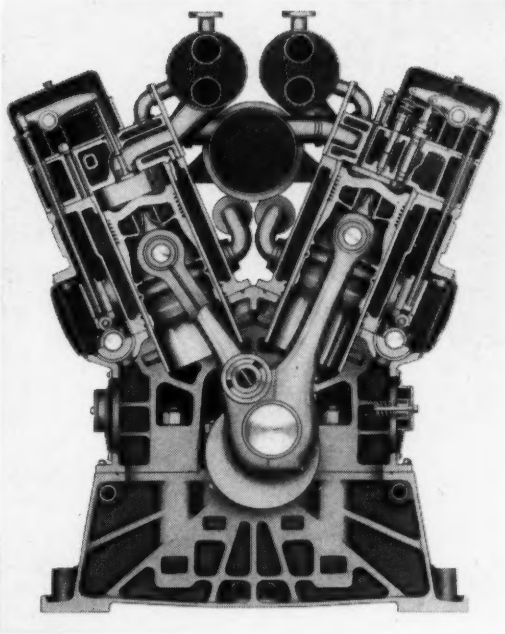


Connecting rod design cuts engine length 20%

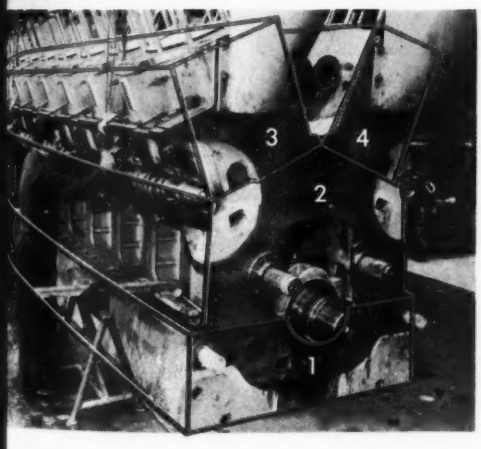
The master-and-link articulated connecting rod permits opposite cylinders in the V to lie in the same plane. Weight-to-horsepower ratio is reduced to only 25 lb. per HP — some 30% less than conventional units.

Completely accessible— easy to service

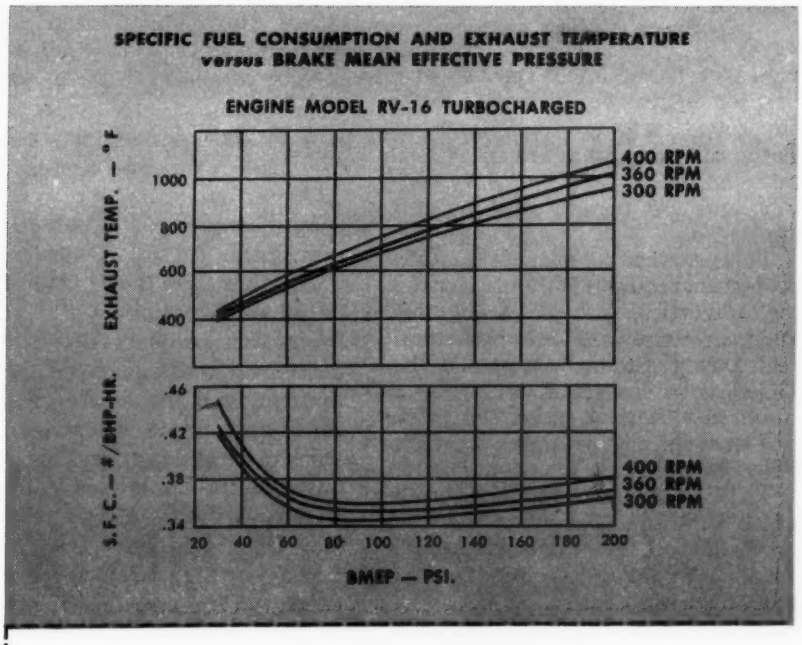
The master connecting rod features a rack-tooth joint for quick and easy removal of the entire assembly. Simply release six clamping bolts and withdraw con rod and piston through cylinder liner.



For practicality in manufacture, shipment, installation and maintenance, the RV engine frame is built in four pieces — base (1), crankcase (2) and two identical cylinder blocks (3 & 4), all of quality-controlled cast iron for maximum strength and rigidity.



The high performance standards achieved by the Enterprise RV-16 turbocharged engine are shown on the curve at right. Tests are made under standard conditions on the 10,000 HP capacity hydraulic dynamometer specially built for this new high-horsepower engine series.



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HOW TO GET AROUND TIME and COST FACTORS

in Protecting Pipe Against Corrosion

When you are faced with the problem of protecting piping underground in highly corrosive soils, a high quality coal tar coating such as called for in AWWA Specifications C-203 and C-204 is normally hot applied at a pipe coating mill. However, in many cases, the volume of pipe does not warrant this expense or the coating mill is too far away to justify the time involved.

That's WHEN Engineers Specify TAPECOAT®

. . . the practical alternate hot-applied coal tar coating in handy tape form

Because TAPECOAT provides a coal tar coating equivalent in long-life protection to hot-applied coating at the mill, engineers are specifying this quality alternate material where time and cost factors preclude mill application.

This practical solution assures the protection required without the need for tar kettles, technical know-how and special crews. Field application costs are reduced because TAPECOAT is so easy to apply, using a torch to soften or bleed the pitch and then spirally wrapping it on the vulnerable surface.

TAPECOAT comes in handy rolls of 2″, 3″, 4″, 6″, 18″ and 24″ widths. Since 1941, it has proved its ability to give lasting protection to pipe, pipe joints, couplings, conduit, cable and insulated piping.

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The TAPECOAT® *Company*

Originators of Coal Tar Coating in Tape Form

1569 Lyons Street
Evanston, Illinois

Notes FROM ABROAD

Packaged Power for Congo

Total electrification of the vast undeveloped rural areas of the Belgian Congo has been proposed in an ambitious project laid down by V. Darchambeau, Belgian engineer and colonial expert.

The project foresees the setting up, throughout the primitive territory of the Upper and Lower Congo in particular, of numerous "pocket-size" power units to bring electricity to each village and plantation, thus encouraging agricultural and industrial expansion.

The proposed power stations would be hydro-electric, completely automatic, economical, and simple. They would be prefabricated and constructed to permit quick repairs even by unskilled native personnel.

Another scheme is the coordinated exploitation of the valleys, integrating projects such as power, industrial, and agricultural development, and the establishment of up-to-date home industries in the surrounding country. This plan is based on the Tennessee Valley Authority — the first step of which is the Inga hydro-electric project. Large power stations are also planned for location between Leopoldville and Matadi.

Constructed to Sink

The multi-million dollar Nikkatsu building in downtown Tokyo, Japan, which includes five floors of offices, four floors of hotel rooms, and a modern shopping center, was constructed to allow the first five floors to sink into the ground. The first five floors were constructed above ground on the marshy earth that covers much of the center of Tokyo, and the ground underneath washed away. The remainder of the building was constructed after the five stories had settled.

Irrigation for Russia

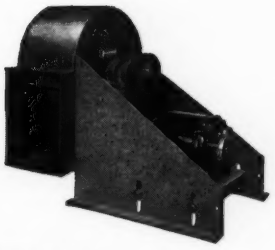
To alleviate the shortage of fresh water in the central and southern parts of European Russia, a Soviet scientist has proposed bringing the waters of the Danube into these areas. According to his plan, a dam would be built at the Danube Estuary and some 200 billion cubic meters of Danube waters directed along the northern shores of the Black Sea eastward through a man-made canal.

Waters from the Dnieper, Bug, and Dniester Rivers also would be carried by the canal which would empty into the Azov Sea. At the Straits of Kerch, a dam would prevent the flow from escaping into the Black Sea. The theory is that these large masses of water would rid the Azov Sea of salt as they flowed through it toward the east. The water then could be pumped up to the Caspian plains for irrigation, with the overflow going to the Caspian Sea. Blocking off the waters of the three rivers from the Black Sea would create a water shortage in the Black Sea that would encourage an inflow of warm Mediterranean waters. This influx of warm waters would bring a milder climate to the Black Sea area.

High Voltage System

Work has started on the 1178 kilometer high voltage transmission line that will run from the Kuibyshev hydro-electric power

nyb



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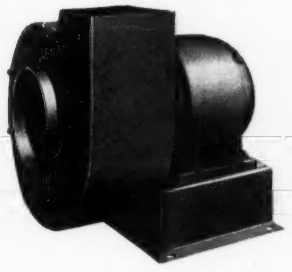
Recommended for their ease of installation,

low maintenance cost and space saving features.

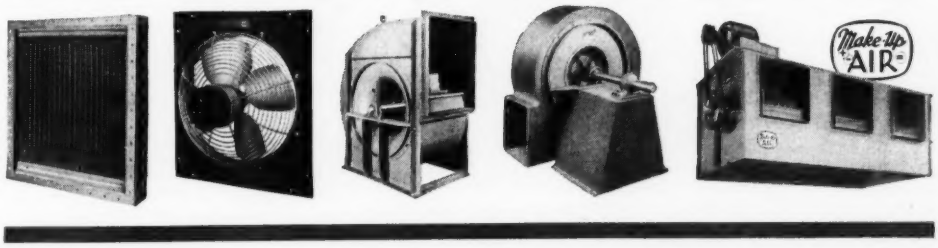
Portable, self-contained units of medium capacities for low pressure industrial and ventilating applications. Designed particularly for use with duct systems.

General Purpose Fans are made in three types and eight basic sizes with capacities from 1200 to 19,000 cfm. (Junior fans in five sizes from 160 to 4100 cfm). These include both direct connected and belt driven models.



No. 10 G. I. Industrial Fan with manganese bronze wheel, spark proof and acid resistant. For use in hazardous locations where explosive air mixtures are to be handled, and for handling hot gases and conveying materials in process. Two arrangements, two types of wheels. All fans reversible. Speeds up to 4500 rpm. For temperatures up to 350°.

nyb products have 65 years of manufacturing experience and engineering knowledge built into them. All ***nyb*** products are laboratory tested, accurately rated and fully guaranteed in strict accordance with standard test codes.



When working on your air handling problems, consult the *nyb* representative nearest you in our nationwide service or write for bulletins.

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FACTORY, LAPORTE, INDIANA

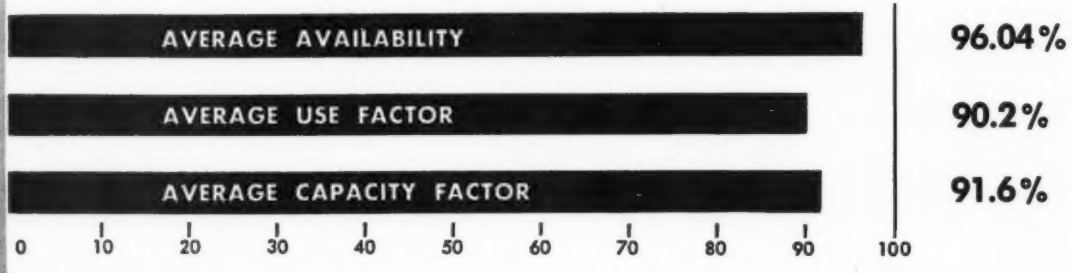
How much is

Operating Record of 99 C-E Reheat Boilers

There are 183 C-E Postwar Reheat Boilers in service, under construction or on order. These boilers represent an aggregate capacity of 22,273,000 kilowatts . . . an average of 122,000 kw per unit.

The first of these boilers was placed in service in September, 1949. By the end of 1955, ninety-nine units were "on the line." The combined service of these 99 units represents a period equivalent to 224 boiler years. Significant data concerning them are summarized below.

Total Capacity — kw	10,932,000
Average Capacity per Unit — kw	110,000
Total Boiler Time — hours	1,974,640
Total Boiler Time — years	224



DISTRIBUTION OF TOTAL OUTAGE	PERCENT
Inspection	2.34%
Boiler • Superheater • Reheater Economizer • Air Heater • Desuperheater — Fuel Burning Equipment	0.96%
(Auxiliary Equipment) Valves • Fans • Soot Blowers • Miscellaneous	0.66%
Total	3.96%

s *availability* worth?

Many of today's high-capacity, highly efficient generating units have a "worth value" reaching into many thousands of dollars for each day that they are unavailable for any reason.

The steady trend to higher unit capacities, pressures and temperatures has, of course, but one principal objective – higher efficiency . . . lower BTU rate per kilowatt-hour.

And it only pays off when the unit is "on the line"

That's no news to the utility industry but the highly satisfactory composite performance record of the 99 C-E postwar reheat units now in service . . . shown on the opposite page . . . has a very direct bearing on the subject.

It adds up to this – the primary objective in the design and construction of C-E reheat boilers is to assure maximum lifetime availability. How well that objective is being achieved is defined by the record.

While this availability story has greatest significance for those consulting engineers engaged chiefly in electrical utility work, high availability ... a built- in characteristic of the entire C-E Boiler line ... is of prime importance to the many consultants who specialize in industrial and institutional applications.

B-927A

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STEAM GENERATING UNITS • NUCLEAR REACTORS • PAPER MILL EQUIPMENT • PULVERIZERS • FLASH DRYING SYSTEMS
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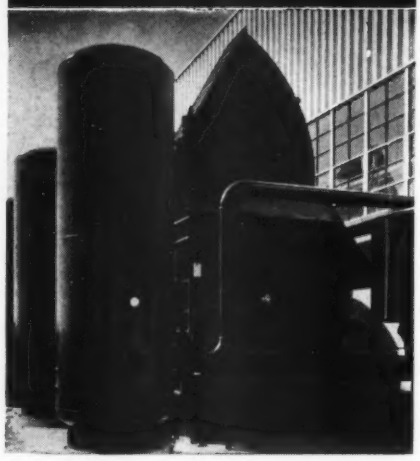
HOW YOU SAVE . . .



. . . getting drier Compressed Air

Direct saving in the cost of cooling water saves the price of the Niagara Aero After Cooler (for compressed air or gas) in less than two years.

Extra, for no cost, the drier air gives you a better operation and lower costs in the use of all air-operated tools and machines, paint spraying, sand blasting or moisture-free air cleaning. Water saving also means less expense for piping, pumping, water treatment and water disposal, or you get the use of water elsewhere in your plant where it may be badly needed.

Niagara Aero After Cooler assures all these benefits because it cools compressed air or gas below the temperature of the surrounding atmosphere; there can be no further condensation in your air lines. It condenses the moisture by passing the air thru a coil on the surface of which water is evaporated, transferring the heat to the atmosphere. It is installed outdoors, protected from freezing in winter by the Niagara Balanced Wet Bulb Control.

Write for Bulletin No. 130.
Address Dept. C.O.

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in Principal Cities of U. S. and Canada

station to the Urals. To carry 400,000 v, it will deliver power to the oil fields of Tataria and Bashkiria and to the engineering and metallurgical centers in the Ural Mountains. Intermediate stations will be built in Bugulma, Zlatoust, Chelyabinsk, and Sverdlovsk.

Microwave System

When completed in 1958, the trans-Canada TD-2 microwave system now under construction will provide television channels and telephone circuits from Sidney, Nova Scotia to Vancouver, British Columbia. The system will have 147 relay stations with an average span of less than 30 miles.

One of the main problems facing engineers in the western section was determining line-of-site locations since 10 of the 13 sites in British Columbia are on mountain tops. On Dog Mountain, inaccessible by road, engineers, construction crews, radio equipment, and a 100-ft portable test tower had to be air-lifted by helicopter. To save the cost of building a road an aerial tramway for maintenance purpose is being built from 400 ft above sea level to the 4800-ft summit.

North-West Telephone Company is engineering the British Columbia section of the system with Robert McLellan, of North Vancouver, acting as consulting engineer for the Dog Mountain aerial tramway project.

Floor on Piles

For the new Shoalhaven Paper Mills erected near Nowra, New South Wales, Australia, 500 concrete piles were sunk 30 ft into the ground to support the floor. They were sunk in situ by the Franki pile system using steel tubes to drop the concrete. A joint venture of the Wiggins Teape Group and William Nash, Ltd., the $3,500,000 plant is 600 ft long, 72 ft to 140 ft wide, and 40 ft high. Gutteridge, Haskins and Davey, of Australia, acted as consulting engineers on the project.

Japan Ups Chemical Production

For the last two years, the Japanese chemical industry has enjoyed a boom because of increased industrial consumption at home and abroad. Production has increased 15 percent a year as compared with a 10 percent increase a year for similar enterprises in the United States.

Dr. Robert S. Aries, head of the New York consulting firm of R. S. Aries & Associates, reported upon his return to the U. S. that three polyethylene plants are being engineered or are under construction and two more are in the planning stage. Acrylonitrile and terephtaltic acid plants are scheduled for expansion to provide enough of these materials for increased synthetic fiber production. Japan is again the world's largest producer of rayon staple fiber and the production of nylon has been doubling each year since 1953. Because of its lack of wood Japan can furnish only two-thirds of the pulp necessary for rayon manufacture.

Chemical fertilizers enjoy relative prosperity in Japan in view of the intensive cultivation of land.

Phenolic resins have doubled since 1950 to 12,000 tons, while urea resins have quadrupled to 40,000 tons, and vinyls have increased 10 times to 45,000 tons. Plans are under way for a 50 percent further expansion in vinyls.

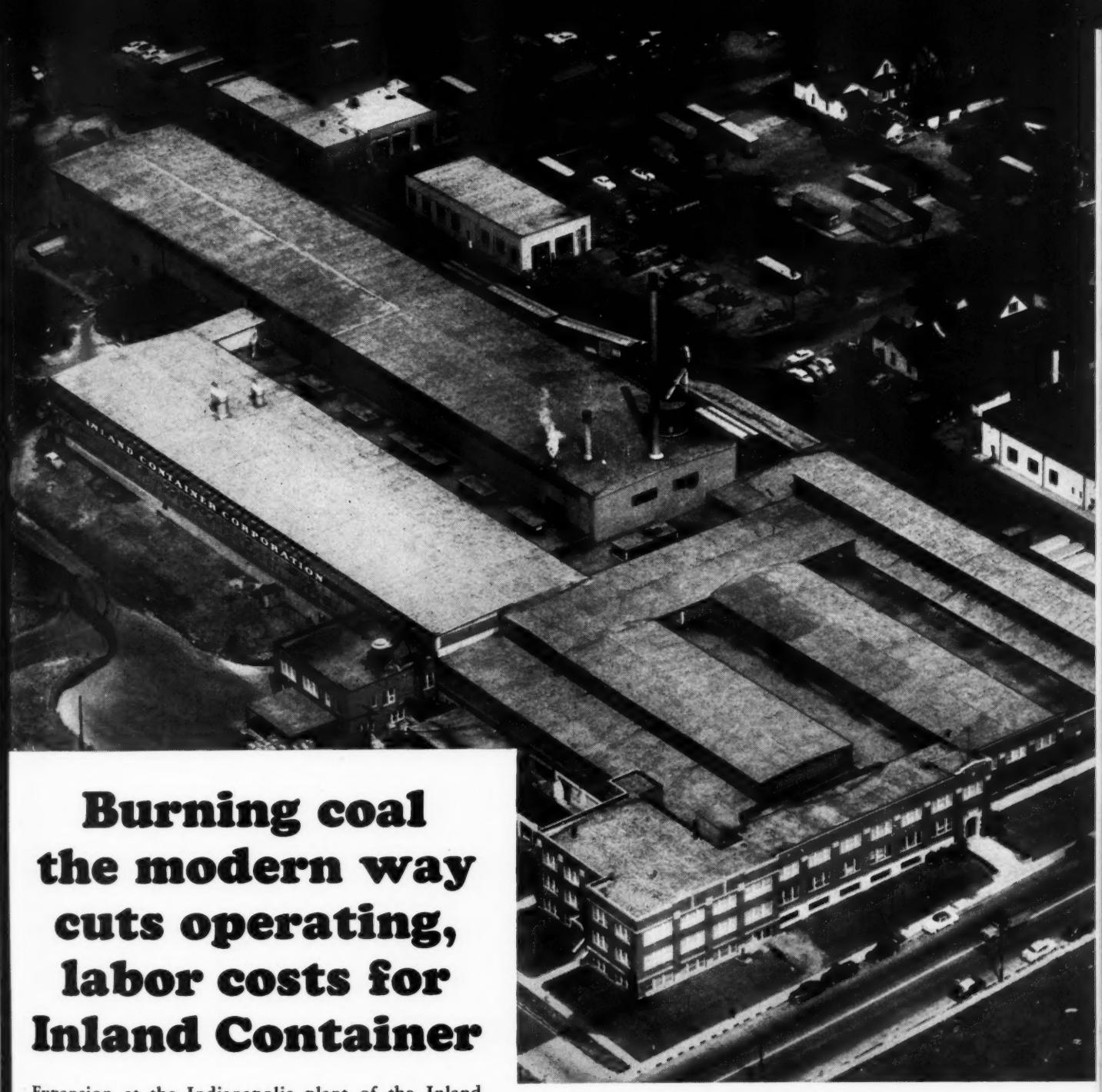
In 1956, Japan will produce about $300 million worth of pharmaceuticals, of which less than 4 percent are exported. Japan is, in the opinion of Dr. Aries, the world's cheapest producer of vitamins, which account for 43 percent of all exports.

Dr. Aries visited Japan at the invitation of Japanese chemical manufacturers for a study of the technical and economic aspects of chemical expansion.

Lignite Mining

Pumping tests conducted at Neyveli in Madras State, India, to determine the feasibility of mining lignite deposits (see "Report from India," July '56 CE) have proved that water flow can be controlled to allow mining. Artesian aquifers beneath these deposits precluded use of open pit mining since the subsoil aquifers were found to exert a pressure of from 6 to 8 tons per sq ft.

A battery of heavy duty pumps, supplied by the U. S. and West Germany, worked continuously for four weeks, pumping out water



Burning coal the modern way cuts operating, labor costs for Inland Container

Expansion at the Indianapolis plant of the Inland Container Corporation required additional steam capacity. The expansion was complicated by the limited space available. Inland's Engineering Department, with the assistance of W. J. Barrows & Associates, Engineering Consultants, solved the expansion problem.

Today the power plant has a new 30,000 lb.-per-hr. boiler and also a 300-ton silo. Liberal use has been made of automatic controls; coal and ash handling have been completely mechanized. Now steam loads are adequately maintained. Boiler room performance has been highly satisfactory and economical. Furthermore, this modernization has enabled Inland Container to effect considerable savings by more efficient operation of its power system.

For further information or additional case histories showing how other plants have saved money burning coal, write to the address below.

NATIONAL COAL ASSOCIATION
Southern Building • Washington 5, D. C.

Note to consulting engineers:

Many companies planning a new power plant, or the remodeling of a present one, consult an engineering firm on its design and construction. When you have such a project, our Engineering Department will be glad to assist you in your fuel cost survey with any coal information you may require. In most cases, for the reasons listed below, the use of coal results in substantial savings in increased efficiency and fuel economy through the years.

facts you should know about coal

In most industrial areas, bituminous coal is the lowest-cost fuel available • Up-to-date coal burning equipment can give you 10% to 40% more steam per dollar • Automatic coal and ash handling systems can cut your labor cost to a minimum. Coal is the safest fuel to store and use • No smoke or dust problems when coal is burned with modern equipment • Between America's vast coal reserves and mechanized coal production methods, you can count on coal being plentiful and its price remaining stable.

EXTRA YEARS

OF MORE DEPENDABLE POWER
and at less cost per pound of steam

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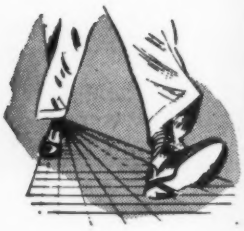
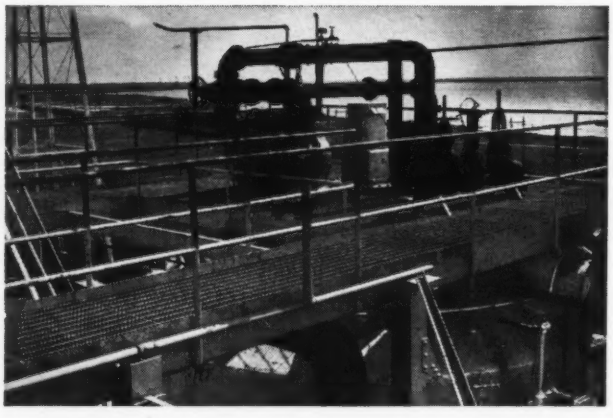
WHERE SURE FOOTEDNESS COUNTS





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Sturdy, one-piece construction with tops of all bars flush provides open steel flooring and stairs for safe, easier walking. Gary Grating is furnished in a wide variety of neat appearing designs and sizes—and is tailor-made to fit your needs. For complete description and installation pictures on Gary Welded Grating, Stair Treads and Gary-Irving Decking, ask for Catalog CE-106

FREE SAMPLE
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ROCKWELL SPRING AND AXLE CO.
4015 East Seventh Avenue • Gary, Indiana

at the rate of 12,000 gpm. It was found that when water level was taken down to 200 ft below ground level, if pumping operations were suspended, water started rising at the rate of 10 ft per minute, until a level of about 150 ft was reached.

Inventions of the U. S. Bureau of Mines are being utilized in the design of equipment for a pilot power plant to use lignite fuel.

This multi-purpose project, estimated to cost $150 million, will produce 3.5 million tons of lignite per year, which will be used for generating 211,000 kw of electric power, two types of nitrogenous fertilizers amounting to 70,000 tons of fixed nitrogen per year, and 380,000 tons of carbonized briquettes for use as industrial and domestic fuel. Abundance of white clay found as an intermediate layer between the surface and the lignite bed will be used for manufacture of ceramics.

Technical Mission to Far East

Under the auspices of the World Health Organization, Dr. John R. Snell, a partner in the consulting engineering firm of Michigan Associates, Lansing, Michigan, is on a three month visit to the Far East. Although the initial purpose of Dr. Snell's visit is to check on the operation of the first Far East high-rate composting plant constructed in Kobe, Japan, his trip has been expanded by W. H. O. to include the study of waste treatment and disposal problems in six different countries in the Orient. He will culminate his tour by heading a three-week seminar on waste treatment and disposal to be held in Formosa, which will be attended by delegates from six Far Eastern countries.

The high-rate composting plant in Kobe, the design of which Dr. Snell assisted in during his trip to Japan last summer, has a present capacity of 25 to 30 tons per day of raw organic wastes composed of garbage and undiluted human wastes that are converted into a stable organic fertilizer in about four days. The process of composting operates at about 150 - 160 F., stabilizes putrid wastes, kills disease-producing organisms, and enables this material to be returned to organically depleted soil.

YARWAY picked for "Preferred" Steam Generators

This installation of Preferred Utilities Mfg. Corp. packaged unit steam generators at a high school in New York State features YARWAY Blow-Off Valves as part of the "package".

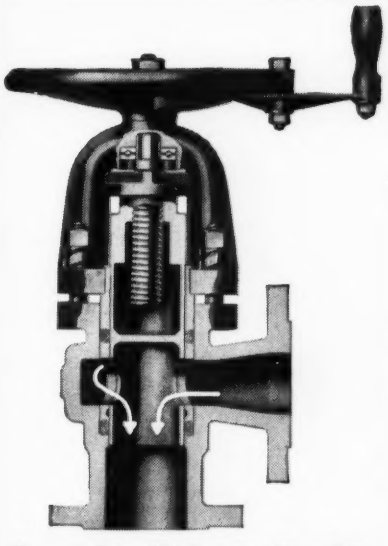
Not only Preferred Utilities, but many other leading manufacturers of package-type boilers now furnish YARWAY Blow-Off Valves on their units. YARWAYS make a *good* package boiler *better*.

The YARWAY Seatless Valve gives drop-tight shut-off and also eliminates the commonest source of blow-off valve trouble. *There is no seat to score, wear, clog or leak.*

Whatever make boiler you use, specify that the blow-off valves be YARWAY *Seatless*. More than 16,000 boiler plants use YARWAY Blow-Off Valves—some for 35 to 40 years.

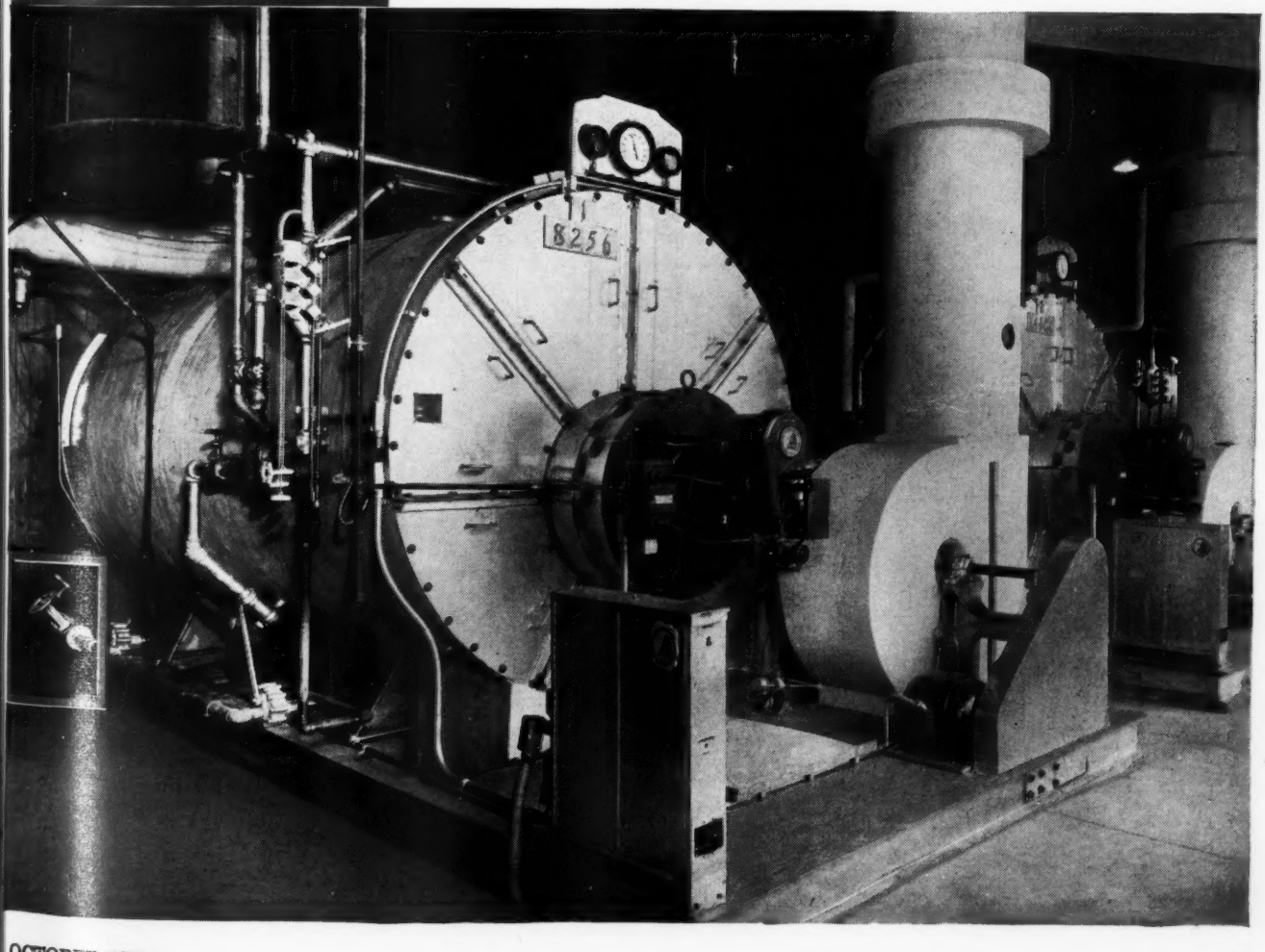
Write for full details in Yarway Bulletin B-426.

YARNALL-WARING COMPANY
106 Mermaid Ave., Philadelphia 18, Pa.
BRANCH OFFICES IN PRINCIPAL CITIES



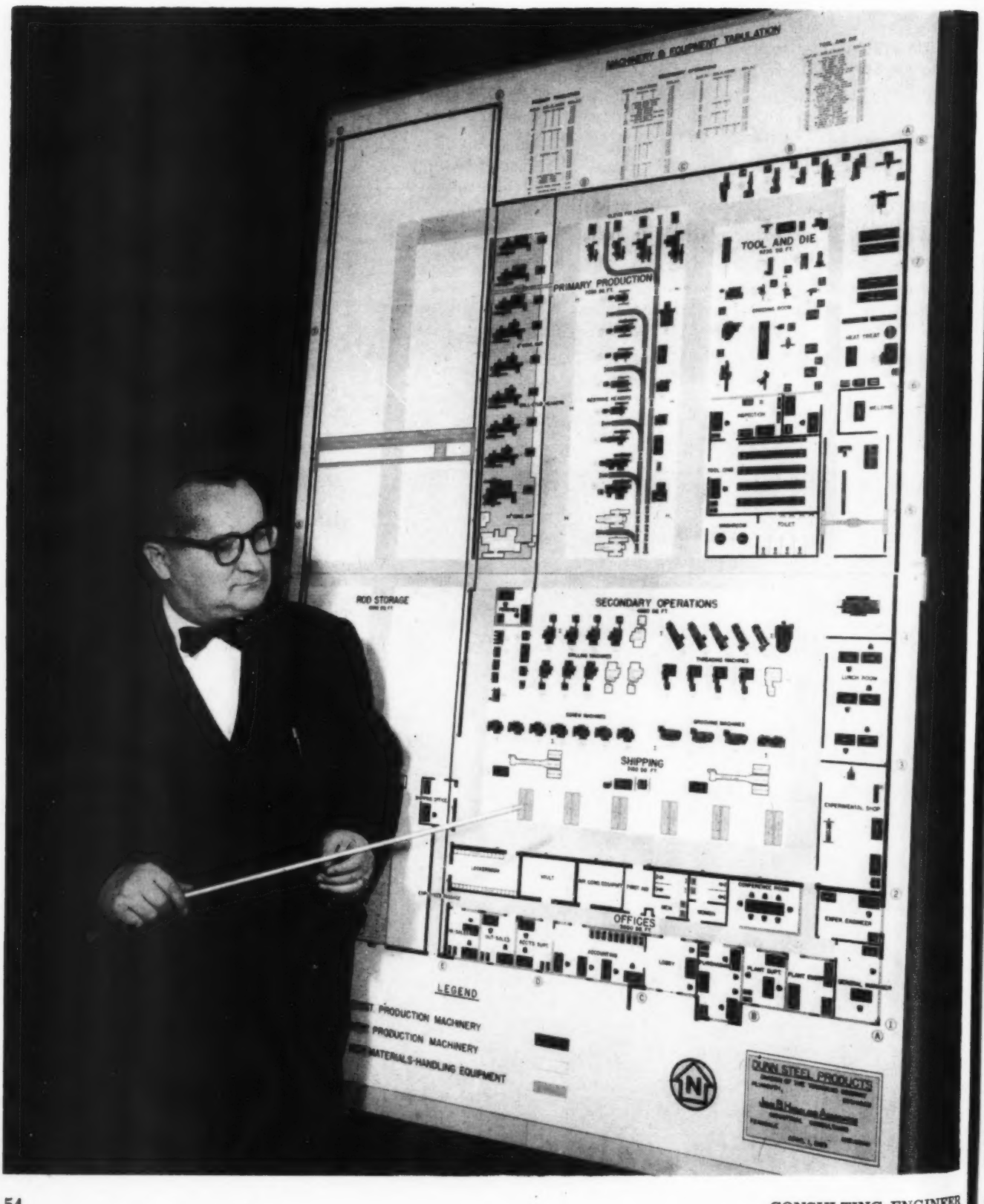
Yarway Type "B" Seatless Blow-Off Valve shown in open position. Note balanced, sliding plunger design. There is no seat to score, wear, clog or leak. Pressures to 400 psi.

YARWAY **BLOW-OFF VALVES**



JOHN B. HARJU EXAMINES THE LAYOUT HE PREPARED FOR THE DUNN STEEL PRODUCTS PLANT AT PLYMOUTH, MICHIGAN. LYLE ZISLER AND ASSOCIATES WERE THE ARCHITECTS, CUNNINGHAM-LIMP CO. SERVED AS GENERAL CONTRACTOR, AND H. SNELLING SUPPLIED STRUCTURAL STEEL FRAMING COST DATA. PLANT IS SHOWN IN PHOTO ON PAGE 55.

Plant Layout... Foundation of Industrial



Plant Planning

JOHN B. HARJU
John B. Harju and Associates
Ferndale, Michigan

John B. Harju graduated from Michigan College of Mining and Technology, in 1936, receiving a degree in Chemical Engineering. He is registered in Michigan as a Chemical and Mechanical Engineer, and also enjoys professional status in New York and Ohio. After graduating from college he held positions with a gas utility company and various industrial firms, in engineering and administrative capacities. Now as active head of his own consulting firm, he draws upon his varied background, and those of his engineering and architectural associates, in assisting industry with plant and production problems.

NO SINGLE FACTOR contributes more than plant layout to the success or failure of an industrial operation. Plant layout can be defined as the integration of grounds, buildings, departments, equipment, methods, materials handling, and service facilities into a master plan of production. The end results of sound plant layout are increased production and reduced manufacturing costs. The fundamentals of plant layout are simple and direct but their application to industrial plant planning becomes complex in that many factors and opinions must be weighed objectively and then brought together in a master plan.

Selecting the Site

Plant site selection must be approached intelligently. Industrial "fore site" is a shrewd quality that provides the jump on competition by aiding the choice of plant sites with superior advantages. Factory grounds should be selected only after the projected plant requirements have been determined and after a comprehensive survey of all the engineering, marketing, and labor factors (see "Consultants Guide to Plant Site Selection," CONSULTING ENGINEER, May 1956) has been made.

Ideally, the plant layout should be made before the site is selected, for only then is it possible to tell whether a proposed site is of sufficient size and has the proper dimensions. The plot also must be large enough to provide for parking facilities (400 sq ft for every 2½ employees) and automobile, truck, and rail approaches.

The general topography of a plant site influences the installation costs of the sanitary, storm, and industrial waste sewers as well as equipment and building foundations. Furthermore, railroad companies usually will not consider sidings with grades over three percent. Never build a plant in a hole.

Subsoil analysis of the plant site is a prerequisite before purchase, design, or construction. Numerous case histories have been recorded where major construction delays and excessive costs were attributed to a solid stone subsoil condition or to inadequate soil bearing properties.

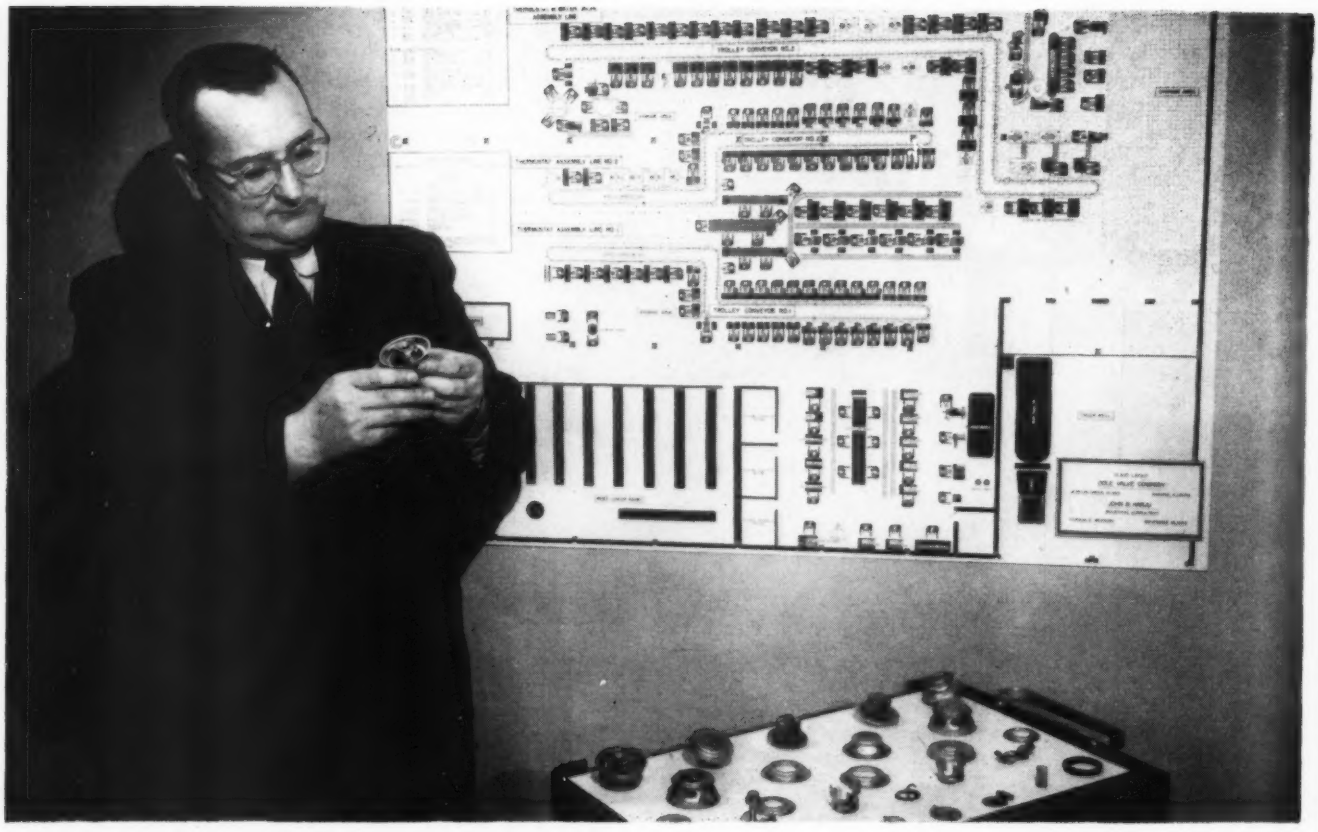
A survey of the power, fuel, and water requirements is a part of any good plant layout program, and the availability of these utilities as well as sewers on any plant site should be investigated thoroughly before the land is purchased. A survey of the sanitary, storm, and industrial waste quantities and their characteristics should be made and presented to the proper local or state agency for determining availability and requirements of disposal facilities.

Industrial Buildings

Plants designed to house operations or processes as integrated by the layout engineer emphasize function. As such they promote greater manufacturing efficiency. Fitting the building around the processes and operations delegates to the plant layout engineer the determination of various building characteristics as well as the size and dimensions of the plant. For example, arrangement of floor space so as to minimize "mass times distance" in the movement of materials through production usually suggests a square or nearly square building. Square buildings also tend to decrease traffic density through departments.

The direct line flow of materials from receiving, through processing, assembly, packaging, and shipping, with no backtracking or recrossing of flow lines during its course, represents the ideal flow of materials in any plant. The plant layout engineer sets his sights with this pattern in mind.

Clearances under the bottom chords of the roof trusses or girders generally are based upon equip-



LAYOUT COVERING NEW CONVEYORS AND REARRANGEMENT OF ASSEMBLY LINES IN EXISTING DOLE VALVE CO. PLANT.

ment and machinery heights or the materials handling facilities such as conveyors or cranes. In certain hot operations such as foundries, forges, and heat treating buildings, however, higher clearances are desirable for improved ventilation.

Column spacing is important in that it is a major factor contributing to building costs. Selection of column spacing for any new industrial plant should be a function of the following:

¶ Size of equipment and machinery.
¶ Size of raw materials and of the end product.
¶ Flexibility required for diversified operations.

The size of production equipment and machinery or the dimensions of the raw materials or finished product generally suggest the column spacing needed. Occasionally, however, in plants such as those for automobile or aircraft manufacture, wide span bays are used to allow for frequent rearrangement of machinery and to permit diversified operations.

Statistics indicate that larger spans result in higher building costs, and it may be that too much emphasis has been placed upon the advantages of wide spans. Sometimes the advantage is lost while the cost remained. For example, floor supported conveyors add intermediate columns to manufacturing areas thus nullifying the advantages of long clear spans. Suspended conveyors, on the other hand, require additional and expensive superstructure when installed in large bays, adding more to the cost. Furthermore, the air space above the bottom chords of roof trusses cannot be used efficiently in most instances. Each 10 feet of roof truss length necessitates approximately one foot of truss depth.

Figures tabulated below illustrate the relative structural framing costs for various bay sizes. These costs include trusses and girders, columns, perlins, and wall framing steel needed to support its own weight, external loading due to normal wind and snow loads, plus a substantial conveyor loading at each panel point of each truss.

Total Steel Framing Costs — 2400 Sq Ft Area

Bay Sizes	Cost*
20′ x 30′	$2880.00
20′ x 60′	$3240.00
20′ x 90′	$3960.00
20′ x 120′	$5040.00

*Steel at $300.00 per ton erected

In most industrial plants today, 50 percent or more of the construction costs of the building are directly attributable to the roof and those elements supporting it. Therefore, the selection of the bay sizes represents the most significant factor in the costs of construction of modern industrial buildings.

Departments

In all industrial plants, departments fall into one of several classifications:

Processing Departments are those in which all machining, processing, assembly, and packaging is performed. These departments must be laid out to ex-

pedite their functions. The least amount of cross-hauling and backtracking in the handling of materials reflects efficient planning.

Departmentalization and isolation of those processes constituting health and safety hazards is necessary in many manufacturing plants. Fire hazards can be localized and such operations as cleaning, plating, painting, sand-blasting, or heat treating can be located and designed so as to improve employee health, comfort, and morale.

Service Departments contain those facilities set up to service processing departments. They include shipping and receiving areas, stockrooms, tool rooms, repair shops, utility rooms, employee rest rooms, cafeterias, and first aid and medical rooms. Service departments should be located so as to minimize any delays in performing their functions for processing departments and their personnel. Multiple units of service facilities often are required in large plants.

Office Departments include administrative, sales, accounting, and production control areas, auditoriums, display rooms, and reception rooms. Office departments may be located in the same building with processing and service activities or in adjacent buildings. The adjacent building tends to be the practice in the larger plants.

Machine Tools and Processing Equipment

Every industry has its own special problems in selection and layout of machine tools and process equipment, and a client commissioning a plant layout consultant expects and deserves a fresh and independent approach to this most important aspect of layout work. Repetition of past mistakes does not reflect sound planning, so it is wrong to depend too heavily on a client's own plant and production engineers.

A good consulting engineer makes use of his broad experience and background to lend creativeness and imagination to his client's problems. He can work with the client's engineers and be of great value not only in the layout and selection of process equipment and machinery but also in specifying those which should be purchased and installed. Location and general specification of all foundations, pits, trenches, and machinery and equipment mountings as well as any auxiliary equipment needed for the installation and operation of machine tools and processing equipment must, of necessity, come under the scrutiny of the layout engineer.

Manufacturing Methods

Progressive administrators in modern industry should know that it is impossible to do today's job with yesterday's tools and expect to be in business tomorrow. Plant-wide problems surveys and research programs are being employed to seek alternate manufacturing methods to obtain better products at lower costs. The high cost of retooling, of investment in new building facilities, and the interruption to existing production programs often delay a change in manufacturing methods until such time as competition forces management's hand. Methods engineering is now left very much to management and their employee engineers, but it is a field in which the consulting engineer could be of service. It is the job of a plant layout consultant to consider methods improvement as a part of his work.

Materials Handling

Most administrators today will admit that their operations could profit from better materials handling. Yet, quite often, failure to explore and to act on this problem reveals the need for better plant layout practices and presentations. The first and most important step in the analysis of materials handling within a plant entails a layout of the equipment and machinery of the operations involved—assembling in one place the complete information affecting the production and handling problem so that management can view it objectively.

The second step in this analysis entails a survey of the various methods applicable to this particular plant. This survey should outline the consulting plant layout engineer's analysis and conclusions by including these studies.

¶ Handling methods applicable.
¶ Recommendations.
¶ Savings to be realized by adoption.
¶ Capital investment required.

A well planned materials handling report provides management with the best visual interpretation of

LAYOUT OF A NEW 325,000 SQ FT PLANT FOR THE TOWNSEND COMPANY, NEW BRIGHTON, PENNSYLVANIA.

how new materials handling methods can be adopted to increase production and reduce manufacturing costs. This approach applies to new and to existing production programs.

In numerous plants today, direct as well as indirect labor performs materials handling operations. Keeping in mind the fact that materials handling adds no value to the end product, the plant layout engineer can recommend changes here that will aid in obtaining management's constant aim of increasing production and lowering manufacturing costs.

Service Facilities

In industrial plants service facilities can be classified as those areas and equipment having to do with:

¶ Receiving, warehousing, and shipping.
¶ Employee comfort, health, and recreation.
¶ Maintenance of buildings, equipment, machinery.
¶ Utilities.

Receiving and Shipping Operations. Although the flow of all materials through processing and assembling operations is the core of good, sound planning, it must be remembered that this flow must have an intake and outlet in order for production to proceed smoothly. Such is the function of the shipping and receiving departments, and more and more attention is being given them in modern planning. It is vital that materials and finished goods be received, weighed, inspected, handled, stored, and released to production rapidly, stored as required, and shipped with dispatch.

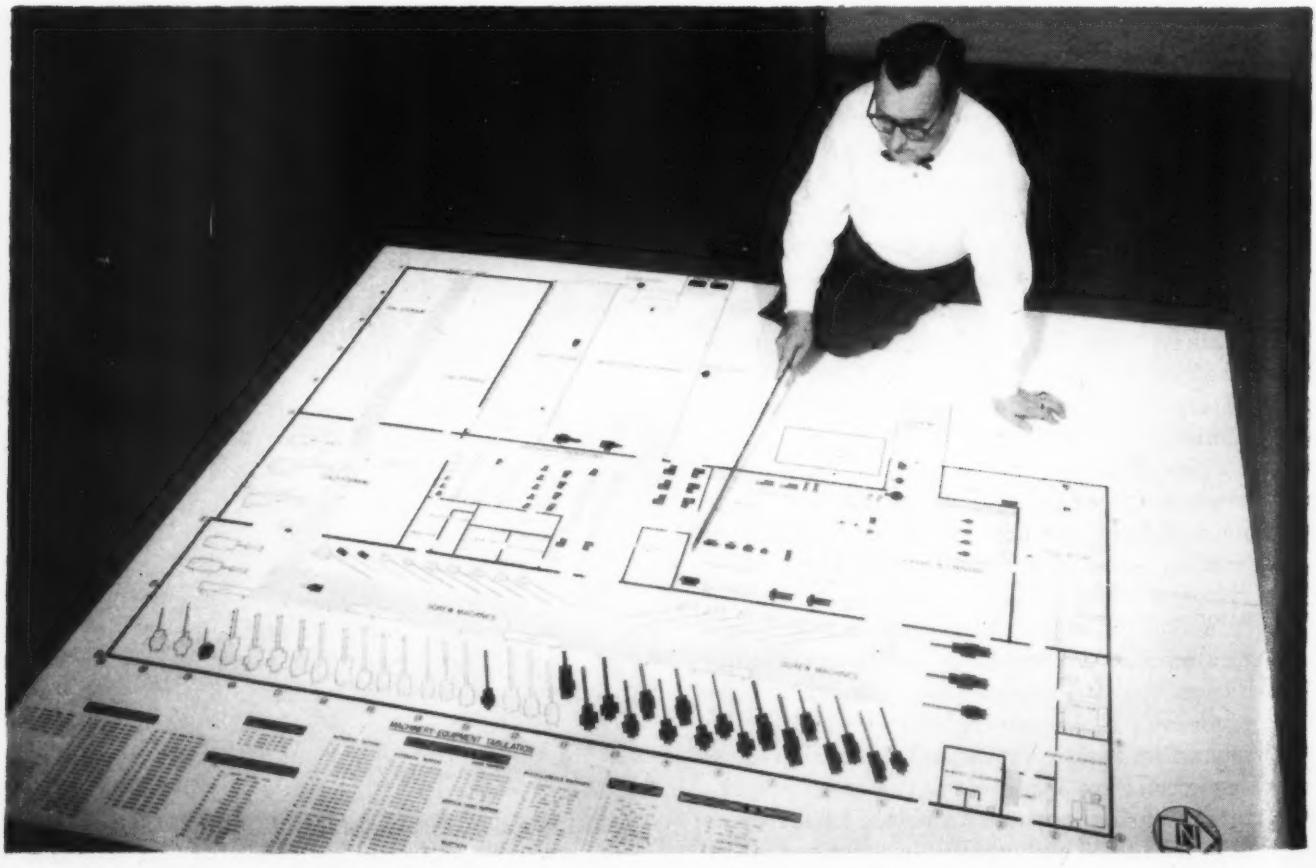
Employee Facilities. In spite of the inventiveness of man, the day when mechanical robots will replace human beings in the operation of industrial plants is not yet here. As long as there are personnel, there will be personnel problems. Keeping employees contented and comfortable by providing clean, safe, sanitary, and attractive workplaces and good recreational facilities is a part of operating a business. Space must be allocated in the plans of the plant layout consultant for parking lots; plant approaches; cafeterias and lunch rooms; first aid and medical facilities; locker and wash rooms; toilet facilities; and recreational areas. In fact the very key to intelligent employee relations is that of satisfying man senses — sound, sight, touch, taste, and smell.

Maintenance Facilities. Production stagnation will quickly occur if production and service equipment is not maintained. Management is viewing with increased concern the production lost by maintenance delays. In locating these departments the plant layout engineer should determine:

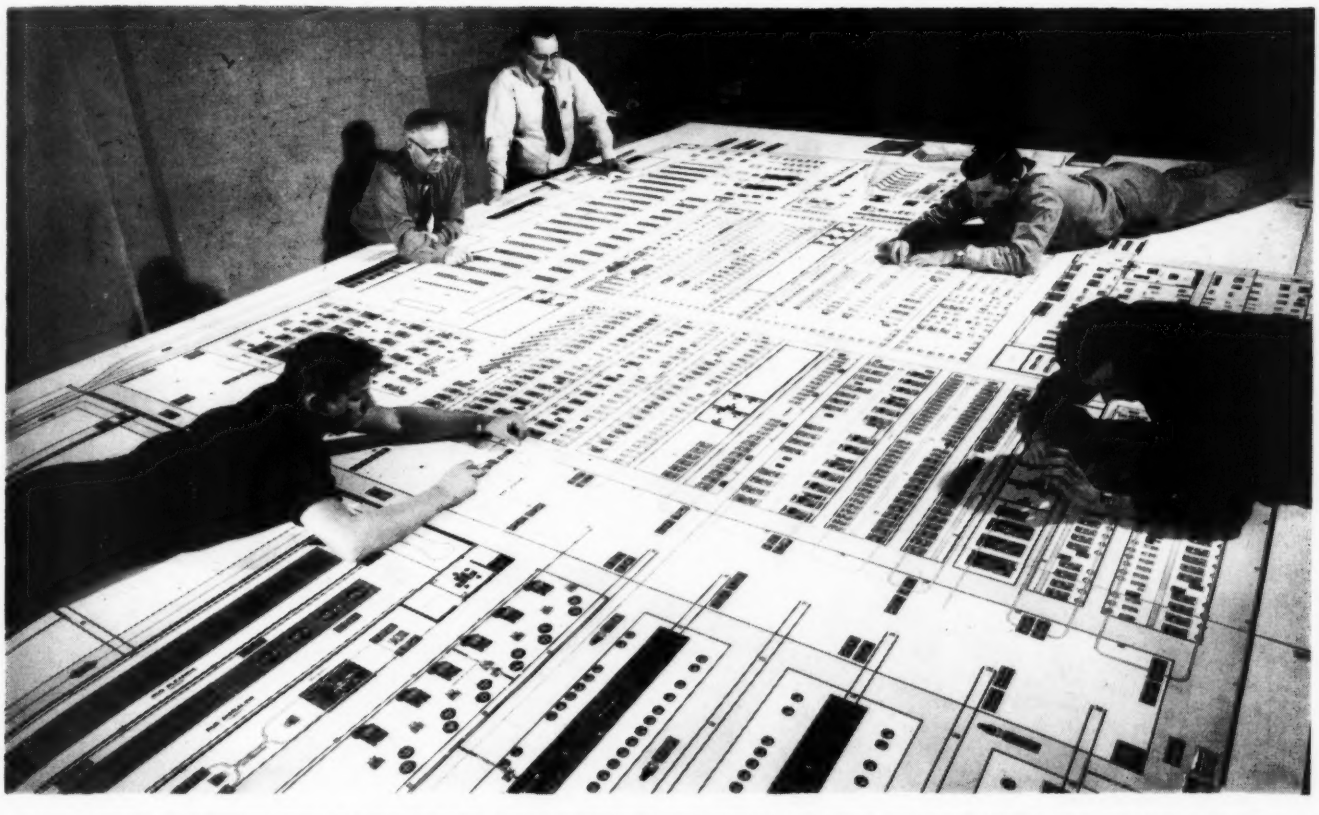
¶ Time lost in direct labor.
¶ Output lost by machine downtime.
¶ Actual cost of making repairs.

Proper layout can reduce all three of these factors.

Utilities Facilities. The layout engineer also must give consideration to space for those utilities that fur-



CONSOLIDATION OF TWO SCREW MACHINE PRODUCTS MANUFACTURING OPERATIONS INTO ONE, 60,000 SQ FT PLANT.



HARJU USES ADHESIVE-TYPE PAPER TEMPLATES MOUNTED ON METAL PLATES IN PREPARING HIS PLANT LAYOUTS.

nish electric power; heating, air conditioning, and ventilation; water; fuel; fire protection; and any special requirements such as compressed air or gas.

An important part of any plant layout survey and subsequent plant layout is the tabulation and description of all electric motors and other electric energy consuming equipment. With this data the layout engineer can allocate space for the transformer substations required. This survey also furnishes the consulting electrical engineer with the process power loads, which together with the lighting loads, form the basis of electrical design.

Another very important consideration of the plant layout survey is the determination of the process air requirements for winter heating and ventilating and summer ventilating or cooling. The process air requirements normally dictate that the production areas be pressurized with outside make-up air, the resulting heating load in many industries representing the major demand on the boiler plant. This analysis thus furnishes the mechanical consultant with the process heat load data, which together with the normal building heat losses will determine his heating and ventilating designs.

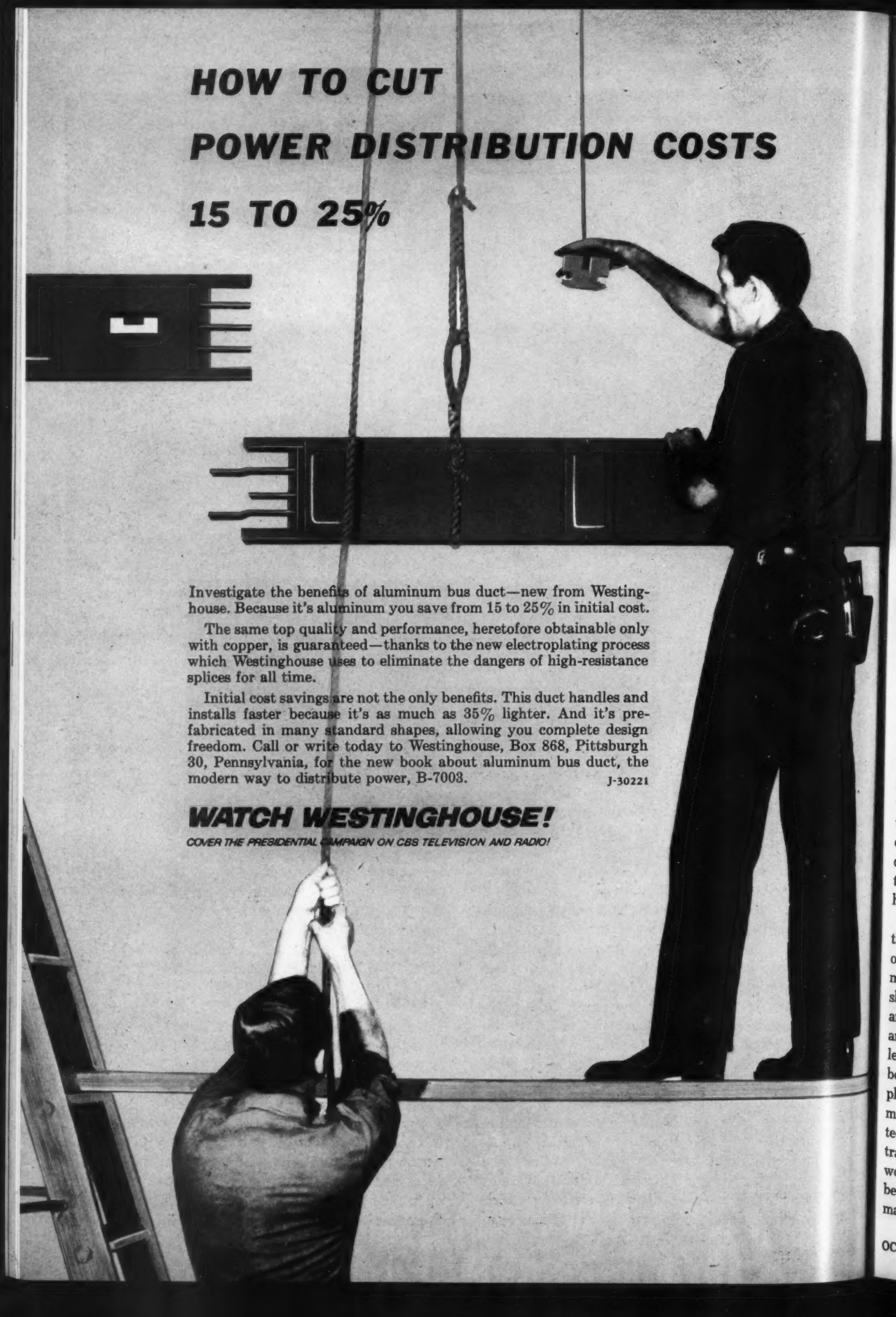
Miscellaneous utilities such as water, fuel, compressed air, and fire protection demand consideration in the layout engineer's planning. Of special importance for providing built-in protection from fire is the specific need for a more scientific understanding of the chemical significance of the three elements which together cause fires — combustible materials, oxygen, and the spark for ignition. By minimizing the opportunity for the three to exist simultaneously, fire hazards can be reduced.

Mechanics of a Layout Program

The actual mechanics involved in preparing a sound plant layout study designed for plant expansion, plant consolidation, or for a new building program requires: (1) job site examination of buildings, machinery and equipment, utilities, and manufacturing methods; (2) scaled reproduction of all machinery and equipment, and methods study and research; (3) preparation of the plant layout; (4) preparation of the plant layout report covering layout analysis, building cost estimates, process equipment cost estimates, savings to be realized, and recommendations; and (5) presentation of the plant layout and the report to management.

What Does Plant Layout Cost?

Records of numerous plant layout programs in terms of manhours required and building construction costs indicate that it takes 750 to 1000 manhours per 100,000 sq ft of plant floor area. The fee to the plant layout consultant could be based on this figure. A sound percentage fee, based again on experience, is one percent of total building construction cost. Sound planning provides industry with the means to meet and beat competition. Plant layout is also an open field for consulting work that is profitable for the consultant and the client. ▲▲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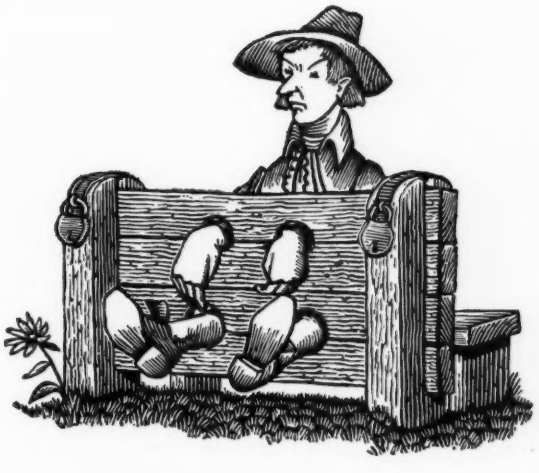
Court Decisions Involving Consulting Engineers and . . .

The Wage and Hour Laws

ALBERT W. GRAY



IN THE LONG AGO COMMENT of Geoffrey Chaucer that double words are sly, might have been embodied a forecast of the confusion surrounding the recent decision by the Federal court exempting the employees of a consulting engineer from the wage and hour provisions of the Fair Labor Standards Act—and that court's later reversal by the United States Court of Appeals.

In the Fair Labor Standards Act there is this statement, "Except as otherwise provided in this section no employer shall employ any of his employees who is engaged in commerce or in the production of goods for commerce for a workweek longer than 40 hours unless such employee receives compensation for his employment in excess of the hours specified at a rate of not less than one and one-half times the regular rate at which he is employed."[1]

In that phrase, "engaged in commerce or in the production of goods for commerce," lies the confusion born of the double words mentioned by the poet.

This particular tale begins when action was brought by the United States Secretary of Labor against a consulting engineer in Iowa for an alleged violation of this provision of the statute. It was maintained by the government that the employees of this engineer were engaged in interstate commerce and did not receive compensation at one and one-half times the regular rate for work time in excess of 40 hours a week.

It was agreed at the trial of this action involving the activities of this engineer that, "his work and that of his associates consisted solely of consultation with municipalities, associations, corporations, partnerships, and individuals with respect to engineering and architectural problems and the giving of advice and recommendations in the solution of such problems. All of these employees except secretarial and bookkeeping employees have knowledge of the application to the art and science of construction, of mathematics, of natural law, engineering, and architectural principles in which they have had special training and must be competent to perform creative work in the development of plans for structures to be erected or remodeled or for the installation of machinery therein as the case may be. The defendant is a member of the American Society of Civil Engineers and of The Iowa Engineering Society."[2]

Its decision that this engineer had not violated the overtime provisions of the statute was measured by the clause of this section of the statute—"the production of goods for commerce." As authority for so doing, the court referred to the message of the President, in 1937, in support of the enactment of this law, that, "To protect the fundamental interests of free labor and the free people we propose that only goods which have been produced under conditions which meet the minimum standards of free labor shall be admitted to interstate commerce. Goods produced under conditions which do not meet rudimentary standards of decency should be regarded as contraband and ought not to be allowed to pollute the channels of interstate trade."

Note that this statement refers to goods, and the court in this instance felt that this consulting engineer had nothing to do with the production of goods. As a further authority for this decision, which conditioned the application of the law to the character of the goods, the court referred to a decision of the Federal District Court in Maryland. In that instance an action similar to this suit against the Iowa engineer had been brought against a firm of professional engineers and architects of Baltimore. In that decision the court also had emphasized that the "production of goods" was not involved.

"In drawing the line between coverage and noncoverage," the Maryland court wrote, "it must be determined whether the questioned activities of the employee have a sufficiently close and immediate tie with the process of production to be covered, or only so remotely connected therewith as to be without the coverage of the Act. In following this approach to the

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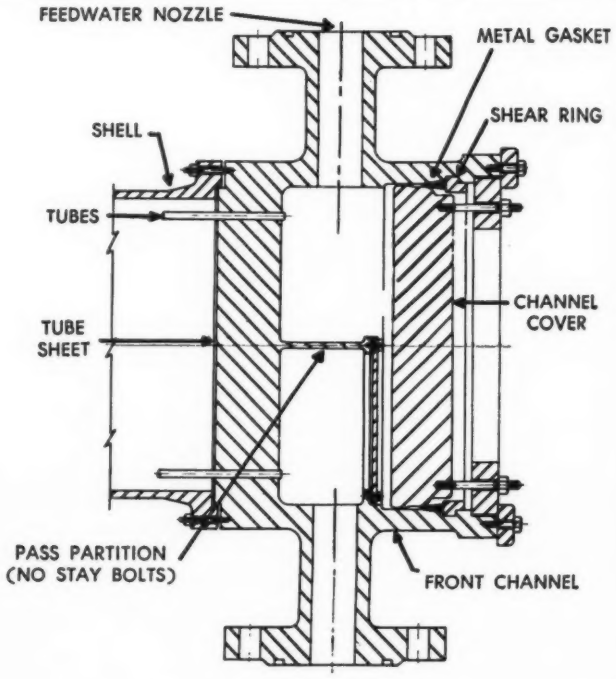

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question, we find in this case that the work of the employees does not have this required close and immediate tie with the production of goods."

To this that court added in conclusion, "Men and machines are doubtless necessary to the production of goods in a factory, and the factory building is doubtless necessary to house the men and machines, and the plans may be necessary for the construction or alteration of the building. The activities of the employees in preparing the plans may be said to be necessary to the comprehension of the architectural or engineering devices, but it seems clear that the employees' activities are only very remotely related to the production of the goods."(3)

Cited by the court in this instance as further authority for holding these Maryland engineers exempt from the wage and hour provisions was a decision of the Supreme Court, which emphasized the services and not the goods as the measure of the reach of this law in its conclusion that a cook furnishing meals to railroad maintenance employees was not within the purview of this statute.

"The test under this present act to determine whether an employee is engaged in commerce, is not whether the employees' activities affect or indirectly relate to interstate commerce but whether they are actually in or so closely related to the movement of commerce as to be a part of it . . . It is not important whether the employer, in this case the contractor, is engaged in interstate commerce. It is the work of the employee which is decisive."(4)

Further Guides

The Federal District Court, in making a decision in the Iowa case, searched for a further decision to guide them. They found that in another case, in 1947, a Federal appellate court had held the wage and hour provisions of this statute did not apply when the goods themselves were made the criterion.

In this case suit had been brought by an employee of a consulting engineer for overtime compensation. His work was merely to determine whether or not charges were extras, within the terms of the contracts, in the construction of a local airplane engine factory. Work orders were drafted by this employee after his appraisal of the charges, and the orders then were approved by his superiors. In its refusal to hold these activities within the provisions of the statute the court said:

"Merely because the occupation is indispensable in the sense of being included in the long line of causation, which brings about so complicated a result as finished goods, does not bring it within the scope of the Fair Labor Standards Act.

"This is so here where an essential local activity is involved and where the gathering of material for the work orders and attending to the mechanics of their approval by three sets of principals is, in itself, so far removed from the sub-contractor's material and equipment shipped to the latter for their work on an intrastate construction. Indeed there is nothing to show that the employer or employee knew or cared where the materials came from as long as they were available when needed."

In conclusion the court added, "Original construction is definitely beyond the contemplation of the Act, and this employment cannot be fairly removed from that category. What he did remotely affected commerce, but the gap between the primary intrastate operation and the collateral interstate commerce feature was not bridged for any practical purposes by the processing and mailing of the orders and letters which appear in this matter."(5)

Decision Reversed

However the decision of the Federal District Court in the action brought by the Secretary of Labor against this Iowa engineer was carried to the United States Court of Appeals for review. There the decision of the lower court, holding the activities of the employees of the engineer outside the provisions of the Fair Labor Standards Act, was reversed, and the United States Supreme Court refused to review that decision of the Court of Appeals.

In its decision reversing the lower court, the Court of Appeals presented the facts in this fashion. "During the period from 1950 to 1953, the stipulation showed that this engineer and his employees participated . . . in construction projects, all located within the state of Iowa, which may be considered in two groups:

"(1) Instrumentalities of commerce. (a) Preparation of plans and specifications for the paving of approximately 37 sections of existing streets in four Iowa towns. Interstate commerce moved over all of these streets both before and after paving. (b) Preparation of plans and specifications for enlarging the power plant and for making further additions to existing equipment of an interurban railroad. Approximately 25 percent of the power produced by the railroad is used in the operation of its railway. A substantial portion of the freight hauled by the railroad is moving in interstate commerce.

"(2) Production of goods for commerce. (a) Preparations of plans and specifications for the installation of additional equipment in the municipal power plant of the city of Pella, Iowa. The power plant supplies electricity to various enterprises which ship a substantial portion of their products outside the state. (b) Preparation of plans and specifications for new headquarters buildings for three rural electrification cooperatives which distribute electric energy to railroads hauling interstate freight; to factories producing goods for interstate commerce; to telephone networks and radio stations for interstate messages and programs; and to a state highway patrol for communications controlling interstate traffic.

"The contracts for the paving of the streets and

for the alteration and improvement of the Pella, Iowa, power plant all provided that the decision of the engineer, as to the meaning of the plans and specifications and as to whether the work was in accordance therewith, was final."

Having stated the basic facts, the court then went on to say, "Since the enactment of the Fair Labor Standards Act, in 1938, the courts have been constantly called upon to determine whether a particular employee or group of employees is engaged 'in commerce' or in the 'production of goods for commerce.' The difficulty has been in finding an acceptable standard for ascertaining whether the employee's activities bring him within the coverage of the Act.

"The Supreme Court recognized this difficulty when it said, 'To search for a dependable touchstone by which to determine whether employees are 'engaged in commerce or in the production of goods for commerce' is as rewarding as an attempt to square the circle . . . each case must stand or fall on its own particular facts.' "

Then in conclusion, "Viewing the activities of the engineer's employees in a practical aspect in relation to the whole construction project and giving to the Fair Labor Standards Act the liberal interpretation required, we are convinced that the stipulated facts in this case demand a holding that the employees were engaged 'in commerce' and that the trial court's conclusion to the contrary was erroneous."(6)

More Confusion

However, two years earlier, further confusion had been injected in a case in Louisiana. In the original action, suit had been brought by the Secretary of Labor, for an injunction against contractors who, it was claimed, were violating this Act in the nonpayment of the overtime of employees engaged in the construction of an embankment and concrete platform of the Algiers Lock, intended ultimately to be made a part of the Gulf Intercoastal Waterway. Instead of using the measuring stick of either the product or the job, the Federal District Court here injected another distinction — a distinction between construction and repair activities. In its decision that these employees were not engaged in interstate commerce activities, the court had said:

"It is clear that persons engaged in the maintenance and repair of interstate instrumentalities are within the coverage of the Act. It is likewise clear that persons engaged in the construction of new instrumentalities are not covered by the Act."

"If the government were simply building a canal which when completed would connect two interstate highways, it would hardly be asserted that the work on such construction was within the coverage of the Act. The mere fact that the Algiers Lock and Canal, when completed, will become a part of the integrated system of intercoastal waterways of the United States should not change this conclusion. Until the Algiers Lock and Canal is dedicated to and used for interstate commerce it cannot be said that the work thereon is 'in commerce' or so closely connected thereto as to be a part thereof."(7)

Two years later, just a month before the reversal decision by the Federal Court of Appeals of the action against the Iowa engineer, the Supreme Court refused to sustain the conclusion of the court in Louisiana that the employees on this Louisiana construction project were not within the wage and hour provisions of the Fair Labor Standards Act.

In so doing the Supreme Court said, "The question whether an employee is engaged 'in commerce' within the meaning of the present Act is determined by practical considerations, not by technical conceptions. The test is whether the work is so directly and vitally related to the functions of an instrumentality or facility of interstate commerce as to be in practical effect, a part of it rather than an isolated local activity. Repair of facilities of interstate commerce is activity 'in commerce' within the meaning of the Act. And we think the work of improving existing facilities of interstate commerce involved in the present case falls in the same category."(8)

The dissent by two of the justices of the court, which might well be an echo of the conclusion of many engineers, was in part:

"We are not dealing here with improving or repairing existing facilities which are already in commerce but with new construction that has never been used in commerce. It seems therefore that the Secretary of Labor has quite recently changed his mind about the application of the Act to new construction not yet used or not . . . part of interstate commerce.

"His change of mind should not change the law. This court, which may change the law, seems to have changed its mind about the same time and without saying why it does so, except that the foregoing cases are of a different vintage. I am unable to distinguish the cases on the vintage test. Without overruling the decisions and a number of cases decided by the Circuit Court, this court brushes them off . . .

"Reliance upon this court's opinion becomes a hazardous business for lawyers and judges, not to mention contractors, who are not familiar with the vintage test."

They might have added that the whole mass of confusion can be a "hazardous business" for engineers in private practice. ▲▲

References

(1) 29 U.S.C.A. Sec. 207.
(2) Mitchell v. Brown, 126 Fed. Suppl. 603, November 10, 1954.
(3) McComb v. Turpin, 81 Fed. Suppl. 86, November 30, 1948.
(4) McLeod v. Threlkeld, 319 U.S. 1248, June 7, 1943.
(5) Kelly v. Ford, Bacon & Davis, 162 Fed. 2d 555, June 12, 1947.
(6) Mitchell v. Brown, 224 Fed. 2d 359, July 12, 1955.
(7) Durkin v. C. W. Vollmer & Co., 113 Fed. Suppl. 235, June 25, 1953.
(8) Mitchell v. C. W. Vollmer & Co., 349 U.S. 860, June 6, 1955.

THE MARAIS DES CYGNES RIVER BRIDGE AT TRADING POST, KAN., ILLUSTRATES CLEAN LINES OF GOOD WELDED DESIGN.

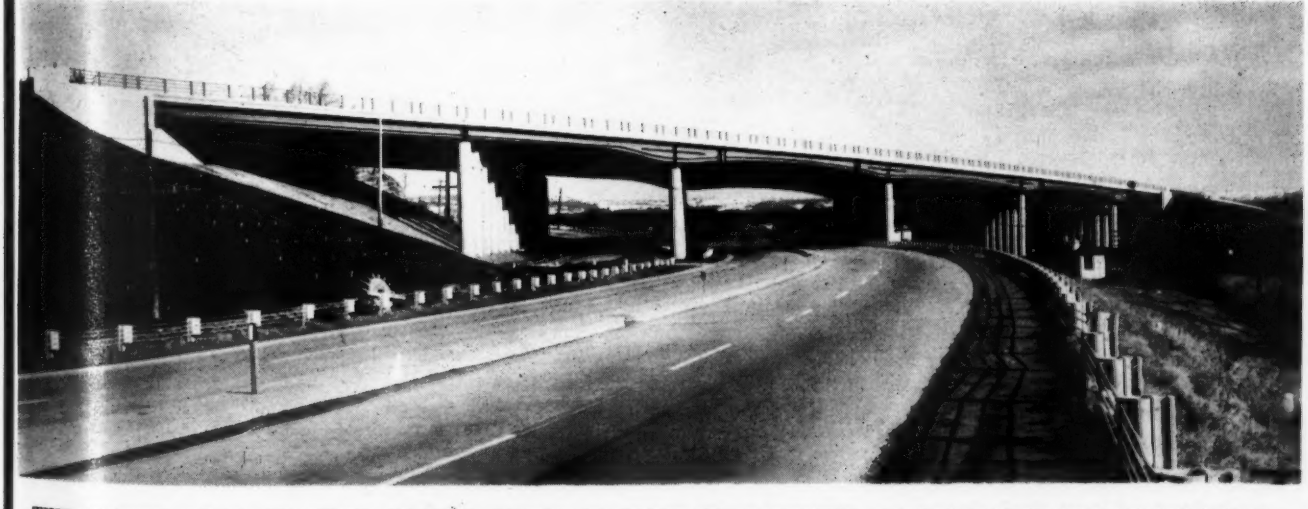
ROBERT G. DYMENT

Experience Aids Engineers in

Welded Steel Bridge Design

SINCE THE END of World War II, welded bridge construction has increased at a rapid pace. Welded construction is now standard for steel highway bridges in New York State, and only recently they completed their first all welded railroad bridge. Other state highway departments and agencies are adopting the trend towards welded bridges.

During the earlier stages of development of welded bridge design, some of the European countries took the lead with outstanding accomplishments in the number of bridges and new types of design. They made some errors in design and construction procedure and in the physical and chemical specifications for steel. These errors were recognized and corrected in subsequent projects, thus affording guidance to later designers. However, most of the welded bridges of Europe that were spared during the war have given excellent service with no difficulties reported during periods of service of more than



THIS 775-FOOT LONG, SIX SPAN, DOUBLE BRIDGE IS COMPLETELY WELDED. IT IS LOCATED ON N. Y. THRUWAY.

ANOTHER SPAN ON N. Y. THRUWAY HAS A DECK AREA OF NEARLY TWO ACRES. LOCATED 30 MILES SOUTH OF BUFFALO, IT CARRIES TRAFFIC OVER CATTARAUGUS CREEK. IT, TOO, IS AN ALL WELDED STRUCTURE.

20 years. Some of the pioneers in welded bridge building were the engineers of Belgium, Germany, Switzerland, Holland, France, Czechoslovakia, Poland, Sweden, England, Russia, and Austria.

Current Status in the U.S.

A survey of state bridge departments has revealed an increasing trend towards the use of welded bridges in this country's rapidly expanding highway system. Of the 39 state bridge departments responding to a survey, 15 (38 percent) are using an increasing number of all welded highway bridges. Another 13 states (an additional 33 percent) are using welding for certain details such as coverplates, diaphragms, and shoes. Many of these states are considering the adoption of completely welded designs for their bridges.

Reported savings in steel in typical bridges resulting from welded design ranged up to 20 percent. Savings in total cost that can be realized on welded bridges also have been reported to amount to 15 to 20 percent—a substantial amount.

The New York Program

Since 1942 the Department of Public Works of the State of New York has designed and constructed approximately 800 steel bridges which, with a few exceptions, have been welded. This is in addition to many reinforced concrete bridges.

Under the direction of E. W. Wendell, until 1954, and since then under C. F. Blanchard, both Deputy Chief Engineers, the Department has been a pioneer in this country of welded bridge construction. For reasons of economy, increased public safety, and pleasing appearance, welding has become standard in New York for deck highway bridges. Practically all of the 500 bridges on the New York State Thruway are welded.

E. J. Ramer and S. Miller, both principal Civil Engineers for the Department, have been directly responsible for the welded bridge designs. Although these men have used welded design for 20 years on various public works projects, most of the all-welded bridges have been built since 1946.

Design Characteristics

The impetus to welded design developed with the change from through-type to deck-type bridges. This deck-type, incorporating composite design, provided safety, functional appearance, and economy through welding. Using the full section of steel members provides for efficient and economical use of material. And where continuous design is used, the over-all depth of the bridge deck usually can be reduced significantly. This not only provides for necessary headroom under the bridge, but effects appreciable savings in steel and total cost. Of equal importance are the savings in the foundations and fills. Saving one foot of the usual fill, when extended on the bridge approaches, can mount to major savings in construction costs.

Welding Techniques

In the New York program, arc welding is used for shear connectors, shoes, additional coverplates to rolled sections, girder fabrication, bracing stiffeners, and splices. All welding is performed by qualified welding operators employed by the contractors, utilizing mild steel arc welding electrodes with covering of the low hydrogen type. The department qualifies all welding operators by having them prepare test specimens in accordance with American Welding Society specifications for welded bridges. Complete data on the samples are listed to show equipment used, voltage applied, and all other pertinent information. This is forwarded to the Department Laboratory together with test specimens. These specimens are tested to destruction and the results sent to the main office for review. The con-

struction engineer in charge then is told whether the welding operator is to be permitted to proceed with the actual welding of a bridge. A complete list of qualified welders is maintained in the main office with the dates that the operator passed his tests. Studies of this list are made to determine the need for future qualification tests.

The Department has established standards for the use of electrodes with coverings low in hydrogen. Many tests and investigations by various interested groups (including the Bureau of Public Roads) have indicated that electrodes with coverings low in hydrogen deposit weld metal far superior to that deposited by the conventional electrodes.

Selection of Materials

The first step in the structural design of a welded bridge is the selection of materials of construction—materials that are adequate for the service conditions of the structure but no more costly than those conditions warrant. Methods and procedures of fabrication and erection have a bearing upon design as well as upon the choice of materials. The three factors, design, materials, and construction methods are interdependent. Decisions cannot be made for any one of these without some knowledge regarding the other two.

Experience and research indicate that the problem of the bridge engineer or the structural engineer in choosing structural steel materials is somewhat different from that involved in heavy plate construction. Apart from differences in service temperatures for various applications, the principal difference appears to be one of geometric shape and proportions, which influence stress distribution and the degree of restraint against ductile behavior. For example, it appears that only unusual bridge or building designs would require as tough a steel as that meeting the recently imposed special requirements for structural steel of thicknesses greater than 1⅜ in. for use in hulls of merchant ships.

Developing Specifications

Numerous attempts were made by both industry and consumer members of the American Welding Society Bridge Committee to obtain agreement on a specification for a weldable steel for bridges. Little progress was made until August, 1951, when at the request of F. W. Panhorst, Bridge Engineer for the California State Highway Department, a conference was called in Washington. It was attended by Jonathan Jones, Chief Engineer, and Paul Gerhart, Chief Metallurgist, Bethlehem Steel Co.; Earl Davidson, Metallurgical Engineer of the U. S. Steel Corp.; and Raymond Archibald, Nathan Morgan, and E. L. Erickson, of the Bureau of Public Roads.

The purpose of this meeting was to obtain agreement with the steel industry for a welding quality steel to be used in the construction of the Bay Shore Freeway elevated highway structures in San Francisco (a Federal-aid project) , which job included the use of some 26,000 tons of steel. Prior to this meeting various attempts had been made to set up a suitable specification, but nothing satisfactory from an engineering viewpoint had been produced.

At this Washington meeting the steel company representatives advised that their mills would agree to furnish "for this project"—the Bay Shore Freeway in San Francisco—a steel meeting the requirements of the job. They supplied a description of the chemical and physical characteristics of the steel, and it was agreed upon.

In January, 1953, Mr. Davidson of the U.S. Steel Corp. presented a proposed revision to the specification, advising that in his opinion this represented the very best that the steel industry would be able

N. Y. THRUWAY BRIDGE OVER ERIE RAILROAD AND ROUTE 59 IS BUILT ON A 2000-FOOT RADIUS CURVE.

WORLD'S HEAVIEST ALL-WELDED STRUCTURE IS THE 9TH AND 10TH STREET CONNECTIONS OF SAN FRANCISCO FREEWAY.

TWO 80-FOOT SPANS OF WELDED PLATE GIRDERS CARRY SINGLE TRACK OF D&H R.R. OVER THE CHERRY VALLEY TURNPIKE.

CONTINUOUS I-BEAM AND PLATE GIRDER CONSTRUCTION WAS USED IN THIS 1955 CROSSING OF ROUTES 84 AND 81 IN TEXAS.

to do with regard to a commercial grade welding quality steel for general use.

Basic Agreement

On January 29, 1953, the Federal Supply Service of the General Services Administration adopted Mr. Davidson's recommendations and published Interim Federal Specifications. This new interim specification was a radical departure from the old Federal specification in that basic requirements for manufacture and testing conformed to current American Society for Testing Materials Specification A6 and A7, which has the effect of substantially reducing mill extras. This resulted in a large monetary saving to the Federal Government. This specification became immediately acceptable to the Office of Defense Mobilization, which had organized a committee to investigate the possibility of conserving structural steel.

The Conference Committee of the Bridge Committee of the American Welding Society adopted this same basic specification as the American Welding Society Specification for Steel for Welded Bridges, on May 27, 1953. Also, the American Society for Testing Materials Committee A1, at their meeting at Atlantic City on July 1, 1953. recommended to the Society that it adopt this specification.

New Specifications

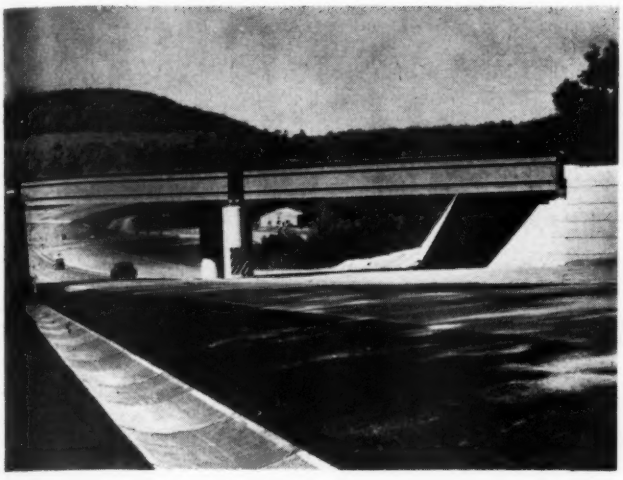
The current situation with regard to steel specifications was reviewed recently by La Motte Grover, of Air Reduction Sales Company. According to Grover, "It is becoming widely realized now in engineering circles that more toughness is required of a steel material that must serve at comparatively low atmospheric temperatures.

"Among the choices of materials, there is first the well known ASTM-A7 structural steel that has been used for many years for both welded and riveted construction. It has an excellent record, but not a spotless one, when one considers service conditions for bridges serving at temperatures of –30 or –40 F in some of our Northern states.

"For example, serious fractures occurred in the trusses of a large riveted highway bridge not long ago. With no provisions for control over carbon and manganese, the adequacy of the A-7 specification has come to be questioned for service conditions of this kind, especially in cold climates.

"To provide a greater margin of safety under such conditions, especially when comparatively thick material is involved and other more exacting conditions prevail, two newer ASTM structural steel specifications are now available with quite complete provisions regarding chemistry — A373, structural steel for welding, and A131, structural steel for ships.

"The new edition of the AWS bridge specifications calls for the newer A373 steel to be used for all new bridge construction in view of more severe service conditions than in ordinary building frames. It is quite possible that some of the state highway departments and municipalities will still use a good deal of



A-7 steel, especially for smaller bridges in warmer parts of the country."

Highway Bridge Experience in N.Y. State

Examples of welded steel bridges are becoming numerous. An all-welded steel bridge nearing completion on the New York State system of thruways will have a deck area of nearly two acres. Carrying the multiple-lane highway over Cattaraugus Creek on the Erie Thruway, about 30 miles southwest of Buffalo, this structure consists of five, 132-ft long spans, each composed of 12, deck plate girders with 5 ft 6 in. webs and 24-in. flanges designed for composite action with the 8-in. thick roadway slab. The deck, 112-ft wide, will carry three lanes of traffic in each direction with safety walks along the outer curbs. Each roadway will be 49-ft wide, 6-ft wider on each side than the approach pavements, and opposing traffic will be separated by an 8-ft raised mall.

Rigid deck-type superstructures with relatively shallow floor depths and open steel railing satisfy the requirements of economy, snow removal, unobstructed vision upstream and down, and pleasing appearance with adequate load carrying capacity, roadway width, and sight distance.

Railroad Acceptance Coming

The New York State Department of Public Works has completed its first all welded railroad bridge. The new bridge is a through-girder, single-track grade-separation structure of two, 80-ft spans designed for E-60 loading and located on a new four-lane divided bypass of U.S. Route 20 around the village of Cherry Valley, N.Y. It carries a branch line of the Delaware & Hudson Railroad and represents the culmination of many efforts to get a railroad company to accept a welded design.

The weight of this all welded bridge is 265,000 lb whereas an all riveted design would have weighed 305,000 lb. This represented a 15-percent saving in steel and money, since the contractor's unit price for the steel was the same for the riveted or welded design. In addition to this saving, they have a welded bridge so pleasing in appearance that no similar riveted bridge can approach it.

Other Outstanding Examples

Examples of other welded bridges are the highway bridge over Cedar River, Linn County, Iowa, where two, 117-ft spans and six, 150-ft spans of constant depth continuous girders are used. This bridge was designed by Howard, Needles, Tammen & Bergendoff, of Kansas City.

The crossing of U.S. Highways 84 and 81 in McLeannan County, Texas, completed in 1955, has a top structure that provides four traffic lanes and a lower structure that handles six lanes. The upper bridge is 1566-ft long and contains 730 tons of metal. The lower bridge is 550-ft long and uses 480 tons of metal. Continuous I-beam and continuous plate girder construction are used. Randle B. Alexander, Bridge Engineer, Texas Highway Department, stated that nearly every steel bridge his department designs with span lengths less than 160 feet is of welded fabrication including all field connections.

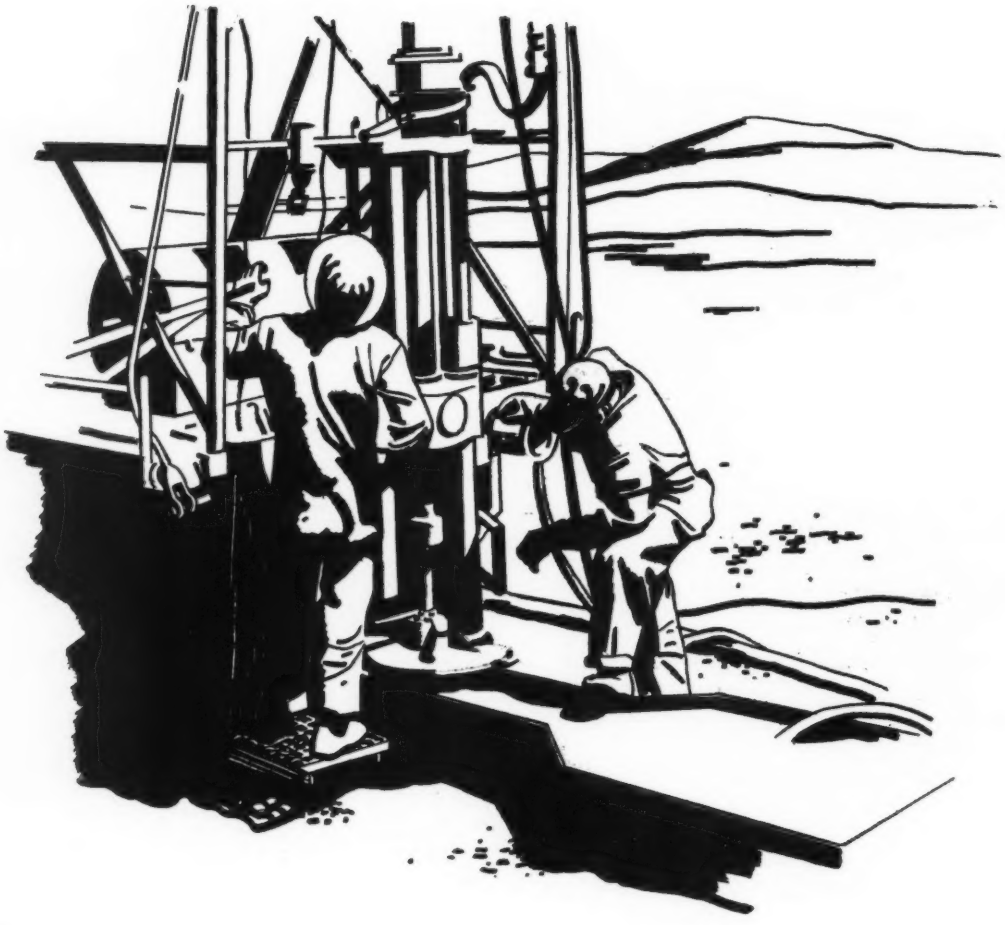
The 9th and 10th Street connections of the all welded San Francisco Freeway Viaduct is another fine example. This is the world's largest all welded structure in terms of tonnage. Spans range up to 170 feet. The deck structure is made of beams and girders with shear connectors welded to the upper flanges to provide a composite construction. Transverse steel bents consist of cap girders supported by one, two, or three columns. Ramps of more than four lanes are supported by two and three column bents; ramps of less than four lanes are supported by single T-column bents. Savings in steel tonnage through welded design amount to an estimated 20 percent.

The Marais des Cygnes River Bridge, at Trading Post, Kansas, is a 128 ft — 160 ft — 128 ft continuous, all welded plate girder bridge, having four lines of girders with light X bracing. Girders are spliced with field welding. Intermediate stiffeners have been omitted from webs on the outside of the girders to save weight and improve appearance.

The Service Road over Hoover Dam Reservoir Project, City of Columbus, Ohio, has eight, 85 ft 3 in. spans of welded haunched plate girders with a 24-ft wide roadway and two, 1 ft 6 in. safety curbs. It was designed by Burgess & Nipple, of Columbus.

There are a number of other interesting welded bridges in service in the U. S., including the West River Bridge, New Haven, Connecticut, over Connecticut Route 69 and the West River. It has a continuous plate girder, two, 125-ft spans, and two, 31 ft 1 in. roadways. The weight of welded structural steel is 759,124 pounds.

The future for welded bridges seems bright, and with the experience so far gained as a background, it can be expected that consulting engineers will be designing them regularly in the future. ▲▲



Use Drilling Mud and Modern Methods for...

Better Soil Test Borings

DAVID M. GREER, President
Greer Engineering Associates

MANY STRUCTURAL and foundation engineers are unfamiliar with the application of modern rotary drilling equipment and heavy drilling fluid for making test borings in soil. Yet, the need for accuracy in soil sample analysis is so important that the consulting engineer should understand the differences in sampling conditions and the effect on samples produced by the use of this technique when contrasted with the more conventional method.

The Drilling Machine

A modern, rotary earth drilling machine, adapted for making test borings in soil, is a modification of the rotary boring machines that have been used for coring rock for the past 80 years or more. The principal modifications are: (1) the soil boring machine must be capable of lower rotational speeds at high torque, in order to turn the larger bit or to push aside gravel; (2) the pump and circulation system must be larger, and designed to circulate "mud" instead of clear water; and (3) the means for applying a downward thrust to the drill stem must be capable of faster motion (at least two feet of movement at a stroke) than is required for rock coring. Some of the best machines meeting these requirements were developed in the Southwest during the 1930's for the oil industry, where they were used for

drilling "shot holes" in seismographic exploration for oil.

A drilling machine of this type, mounted on a 2-ton truck, and equipped for soil sampling work, is illustrated. The machine is capable of making holes of from 4 to 12 or more inches in diameter in any material from soft clay to rock. It can be used to drive casing; to drive the conventional split-barrel sampler (sometimes referred to as the standard penetration sampler); to push Shelby tube samplers of any diameter up to 5 inches; to push down the rod-actuated piston type sampler; to pump down the hydraulically operated piston type sampler; to take samples with the Denison or other type of rotary soil coring barrel; or to take diamond cores of rock. Under most conditions, with the proper use of drilling mud, it can be used to drill a straight, clean hole through clay, clean sand, or even gravel and accomplish the appropriate sampling without the use of a casing to keep the hole open.

Why Holes Close In

Everyone who has used a posthole auger in soggy ground knows what happens when the auger is withdrawn. The hole closes in. Consider the stress condition that makes it do so. Before the hole was bored, the horizontal stress was equal in all directions, and in magnitude was about ½ to ¾ of the weight of the soil above it. After the hole is bored, the horizontal stress on the circumference of the hole is reduced to zero, while a few inches outside the hole on the same plane the stress remains practically unchanged.

Unless the soil structure has enough strength to withstand this unbalance of stresses, it will move. If a soft clay, it will flow plastically, closing in radially until there is no hole left — just a little star-shaped crack. If sand, it will slough into the hole, filling it from the bottom up. If the water level in the hole is lowered below ground-water level, the action is accelerated because seepage forces then are added to the intergranular stress unbalance.

The casing that ordinarily is driven in the course of making a test boring is for the specific purpose of preventing the hole from closing. The drilling "mud" (heavy drilling fluid) used with rotary drilling rigs serves the same purpose.

Drilling Mud

Drilling "mud" is, essentially, a slurry of soil and water. In order for the slurry to be stable, the soil constituent must be so fine that it will not settle out, or will settle out only very slowly. For this reason, clay ordinarily is used. It may be a commercially prepared bentonite, such as Aquagel, produced for the purpose, or it may be a "self-mud" made from the material removed from the hole during boring. The term "mud" is misleading to the uninitiated, for the slurry is a fluid of about the viscosity and consistency of buttermilk. Its unit weight ordinarily is around 7 to 9.5 lb per gallon although, by the use of high-specific-gravity additives, unit weight can be raised as high as 20 lb per gallon for special purposes.

How does this mud keep a hole from caving? It sets up an outward pressure on the walls of the hole that balances, or comes sufficiently close to balancing, the active earth pressure developed by the soil tending to move into the hole (see Fig. 1). To be successful the hydrostatic pressure of the mud must be greater at any level than the ground-water pressure at that level. The hole tends to lose water to the surrounding ground, and in seeping out the escaping water forms a film of clay on the walls of the boring. This clay layer is termed the filter cake or filter skin. If the drilling mud is properly constituted, this layer is nearly impervious even though it is not more than a few millimeters in thickness. In analyzing the effect of mud pressure on the walls of the hole, this filter skin may be considered to be a continuous impervious membrane.

Establishing a Filter Skin

The filter skin can be established only where the ground is of a type that will allow water to escape from the hole in appreciable amounts. It comes as a surprise to engineers who are familiar only with clear water drilling that clean sand can be drilled, an open hole established, and a sampler lowered repeatedly to the bottom of the hole without encountering any material that has sloughed from the walls of the hole. Further, such a hole will stay open as long as the mud pressure is maintained in it. This is true of any sand — fine or coarse, uniform or well-graded, rounded or sharp.

When layers of clean gravel are encountered, without fines in the voids, permeability is sometimes so high that the drilling mud escapes into the gravel, and no filter cake is formed. Then the mud loses its effect, and gravel sloughs into the hole. Such formations require the use of an additive to fill the large voids before the filter cake can be established and the hole stabilized. A commercial preparation, Gel-Flake, is used for this purpose; bran, oatmeal, and cottonseed hulls also will work. Sometimes even the best additives fail. Then the gravel layer has to be cased off before drilling can proceed.

Thixotrophy

Another property of a good drilling mud is thixotropy. While being circulated the mud is a heavy fluid, and as it flows upward in the bore hole, its high density reduces the buoyed weight of suspended cuttings, reducing their tendency to settle. Furthermore, its viscosity decreases their rate of settling, so that compared to water, relatively low mud velocities are required to carry out of the hole even large gravel particles. When circulation stops

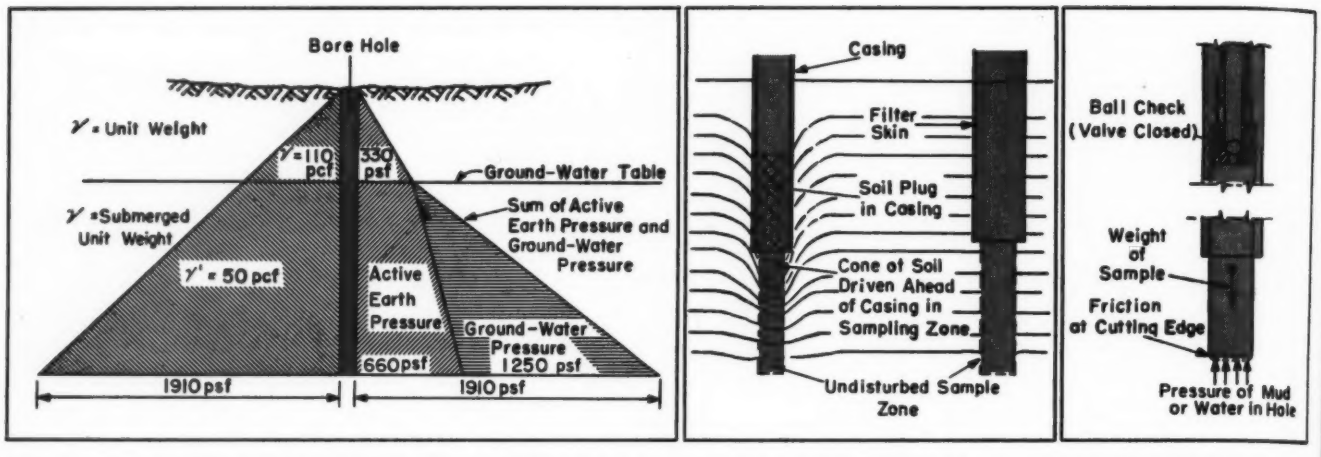


FIG. 1—LEFT. CHART SHOWS ACTIVE EARTH PRESSURE AND GROUND-WATER PRESSURE BALANCED BY MUD PRESSURE

FIG. 2—CENTER. SECTIONAL VIEWS THROUGH TWO TYPICAL BORE HOLES SHOW, LEFT TO RIGHT, THE DISTORTION OF SOIL STRATA PRODUCED BY DRIVING PIPE COMPARED WITH SOIL STRATA UNALTERED BY MUD STABILIZING BORING.

FIG. 3—RIGHT. DRAWING SHOWS THE FORCES ACTING ON SHELBY TUBE SAMPLE DURING REMOVAL FROM BORE HOLE.

entirely, as during sampling operations, thixotropy comes into play; the mud gels and quickly acquires enough shearing strength to prevent even fine gravel particles from settling out.

Sampling Operations

While drilling mud assists in the making of a clean stable hole, it is also important to consider what effect it has on the operations involved in taking soil samples and what effect it has on the composition, condition, and quality of the samples themselves.

In practice the use of mud does not affect the sampling operation. The sampler is filled with the fluid mud before it is pushed or driven into the soil at the bottom of the hole. This fluid is displaced by the sample and escapes through the vent in the top of the sampler. Because the mud is more viscous than water, sampling tools designed for use with mud have larger vents than those designed for use with water. The viscosity of the mud has no observable effect on the speed of sampling or on resistance to penetration.

Sample Disturbance

To evaluate the effect of the use of drilling mud on sample disturbance, it is necessary to consider first the effect that the driving of a casing has on soil to be sampled. Inevitably, the soil is disturbed both by displacement and by the shock transmitted to it by the driving operation. Soil not only is dragged down by friction with the pipe and couplings, but more important, soil clogs the casing and forms a cone-shaped mass that travels with the casing, displacing the soil below as the casing advances. The resulting distortion takes the form shown in Fig. 2. Clearly, an "undisturbed" sample taken immediately below the bottom of the casing, will include several inches of completely remolded soil from a higher level and several inches of partially remolded soil. Appreciable disturbances may extend to a depth below the casing tip of as much as five diameters.

In the mud-stabilized bore hole, on the other hand, no such remolding occurs. Strata below the bottom of the hole remain uncompressed.

Mud Provides Better Sample

Clayey soils, silts, and fine sands are completely uncontaminated by the mud. Coarse sands, under some circumstances, can pick up a small amount of mud — perhaps 1 or 2 percent. But it should be remembered that when mud is not used, sands can be and often are altered during sampling by having clay or silt particles washed out of them by the clear drilling water. In general, the use of drilling mud produces samples that are less disturbed and less likely to be changed in composition than does the use of a casing and clear water.

Sample Recovery

By using the properties of drilling mud fully, the driller can obtain far better sample recovery than by using clear water in the hole. Consider what happens when a sample is taken and then lifted to remove it from the hole. The forces acting on the sample are shown in Fig. 3. The purpose of the ball check valve in the head of the sampler is to keep the pressure of the column of fluid in the drill stem off the top of the sample. If the ball valve leaks, this pressure is transferred to the top of the sample. It will be equal to or greater than the upward pressure exerted by the fluid in the bore hole on the bottom of the sample, and the only force left to prevent the sample falling out of the sampler is the friction at the cutting edge. One effect of using

mud instead of water is to greatly reduce the leakage through the ball check valve.

Assuming that the ball check valve does not leak, the remaining point of weakness is the contact between sample and sampler at the cutting edge. There will be a pressure differential across this contact between the fluid in the bore hole and that in the annular space between sample and sampler. Therefore, fluid from the bore hole will attempt to enter the sampler. If the fluid is clear water, it will tend to wash a channel through this contact, thus relieving the pressure differential and allowing the sample to slip out of the tube. If the fluid is mud, it will seal any leaks that open and preserve the pressure differential. Consequently, it is much easier to get good recovery when mud is used.

Undisturbed Sand Sampling

By careful use of the proper weight of drilling mud, correct sampler design, and great care in sampling technique, it is possible to take, below the water table, samples of clean sands that are almost perfectly undisturbed. This technique has been especially useful in obtaining samples suitable for relative density measurements, which often are more reliable than penetration-resistance data as an index to the structural behavior that can be expected of a foundation sand.

Detection of Changes

The objection sometimes is raised that the use of drilling mud instead of water makes it impossible to detect changes in soil texture as the boring is advanced. This is not correct. It is admittedly more difficult to detect color changes when the drilling fluid is mud, but whenever water is recirculated it usually becomes muddy, and the same objection applies. The only way to avoid the difficulty is to have a fresh water supply, and not recirculate — and that procedure is seldom practical.

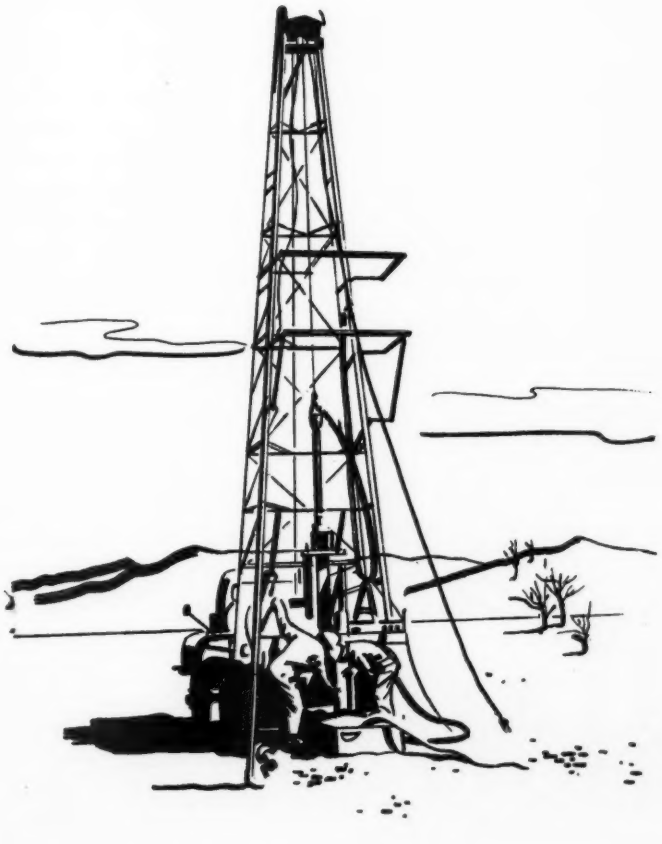
Actually, there are many tricks that a good driller can use to detect and identify stratum changes. When drilling in clay the driller stops rotating every few inches or whenever the feel of the machine makes him suspect a change to sand or silt. He sets the bit on the bottom of the hole and increases the pump speed slightly. If he is in sand or silt the drill stem will drop in a series of jerks as soil is washed out from under the bit.

If the soil is still a clay, the drill stem will not drop. If the indication is of clay and further evidence is needed, the driller can resume rotation, and, applying downward pressure through the hydraulic cylinders on the rig, hog the cut for a few seconds. Then he stops the downward motion while he speeds up the mud pump. This will wash out large chips of clay, which can be caught at the surface, wiped free of mud, and cut open with penknife or thumbnail to allow examination of the structure, consistency, and texture of the soil. The use of the rotary drilling machine here permits the cutting of large intact chips of cohesive soil; the use of mud permits them to be carried out of the hole quickly and unsoftened, neither of which could be accomplished by the use of a chopping bit and clear water.

Actually, changes from cohesive to cohesionless soils, or vice versa, are detected easily when drilling with mud. Determination of the structure and consistency of cohesive soils is much facilitated.

Faults in Sampling

A surprisingly large percentage of the samples received in the laboratory as undisturbed, when taken in Shelby tubes, either with or without the use of a piston, are worthless for testing. The most common fault is that the sample tube is partially filled with cuttings. The bottom portion of the sample, which initially might have been rated as being undisturbed, has had an opportunity to absorb water from the cuttings and to expand vertically. Also, the bottom portion of the sample probably has been disturbed in the sampling operation, since the sample tube was already partly filled with cuttings before being pushed its full length below the bottom of the bore hole.



A second fault, very common in samples taken in soft clay, is that the supposedly undisturbed sample turns out to have a vertical hole through it — sometimes for its full length.

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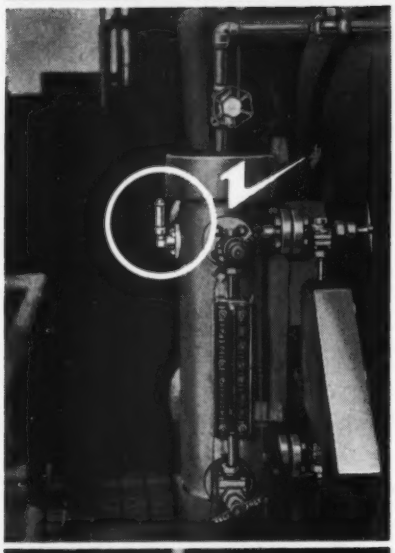

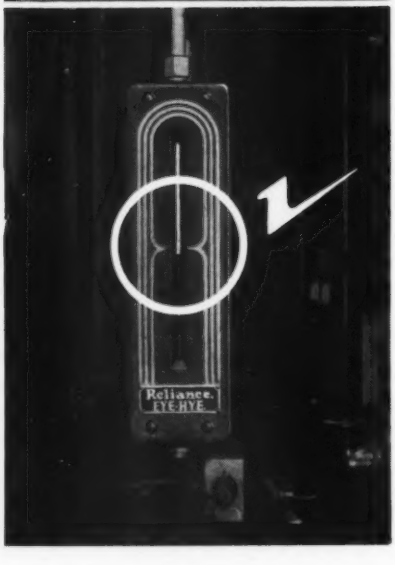

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The usual conclusion of the engineer or inspector who examines one of these samples in the laboratory is that the hole has been made by the jet of water (or mud) from the bottom of the drilling bit. This has led to insistence upon the use of a cleanout auger, or a rotary bit with shielded jets.

A little experimenting with a rotary bit and a pump, however, should be sufficient to prove that the jet from a rotary bit will not make a straight hole of nearly uniform diameter and two feet in length. The type of sample described results when the bore hole is cleaned out but closes in on itself before the sampler reaches the bottom of the hole. The sampler is filled from the walls of the hole on the way down. When pushed below the bottom of the hole, it picks up a short plug of additional soil, which makes it look like an undisturbed sample when removed from the bore hole.

The remedy for this sort of mis-sampling lies in the use of drilling mud of sufficient weight to keep the walls of the hole from closing in. The use of a special cleanout auger is not sufficient unless mud is used, and with mud, the auger is not needed. It even may be detrimental to keeping the hole open.

Here, then, are the main advantages of the use of rotary drilling methods and drilling mud for taking soil samples. But one point must be emphasized — although the use of drilling mud facilitates undisturbed sampling, the operator's skill and knowledge of drilling is still paramount ▲▲

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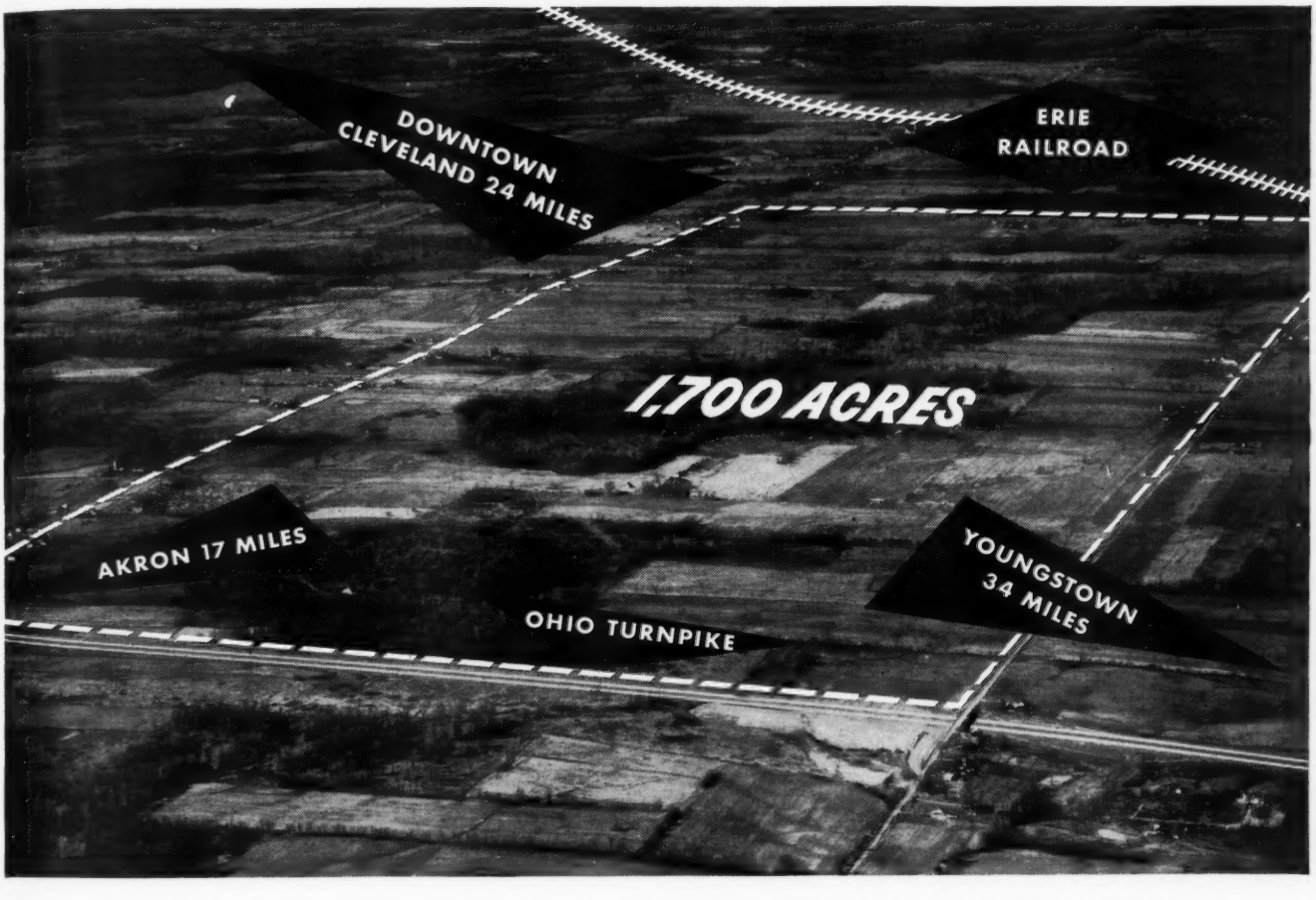

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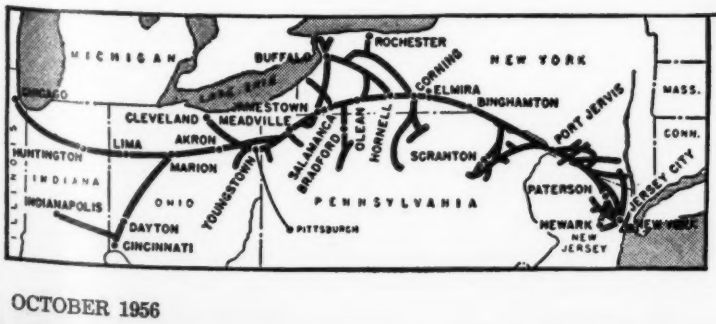

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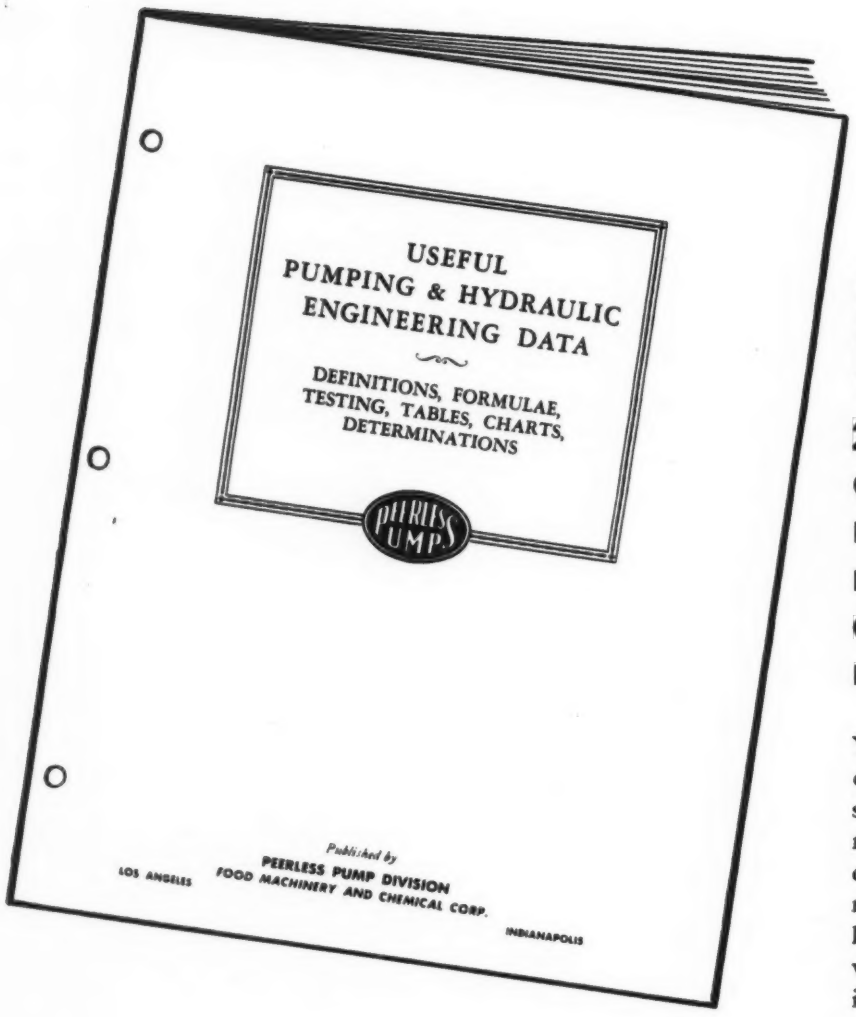

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To see how far this method can be extended, we will look at processes not conventionally shown in block diagrams. In fact, one must look carefully with some imagination to see that, after all, these are block diagrams.

Adaptation of Turbine Flow Diagram

First, consider a turbine manufacturer's study of instrumentation for the acceptance test of a large turbine generator unit. In Fig. 1 we have a flow diagram showing that this 160,000 kw unit will consist of a high pressure and intermediate pressure turbine on one shaft, serving one generator. Two double flow, low pressure, condensing turbines are cross-compounded and are both on one shaft serving

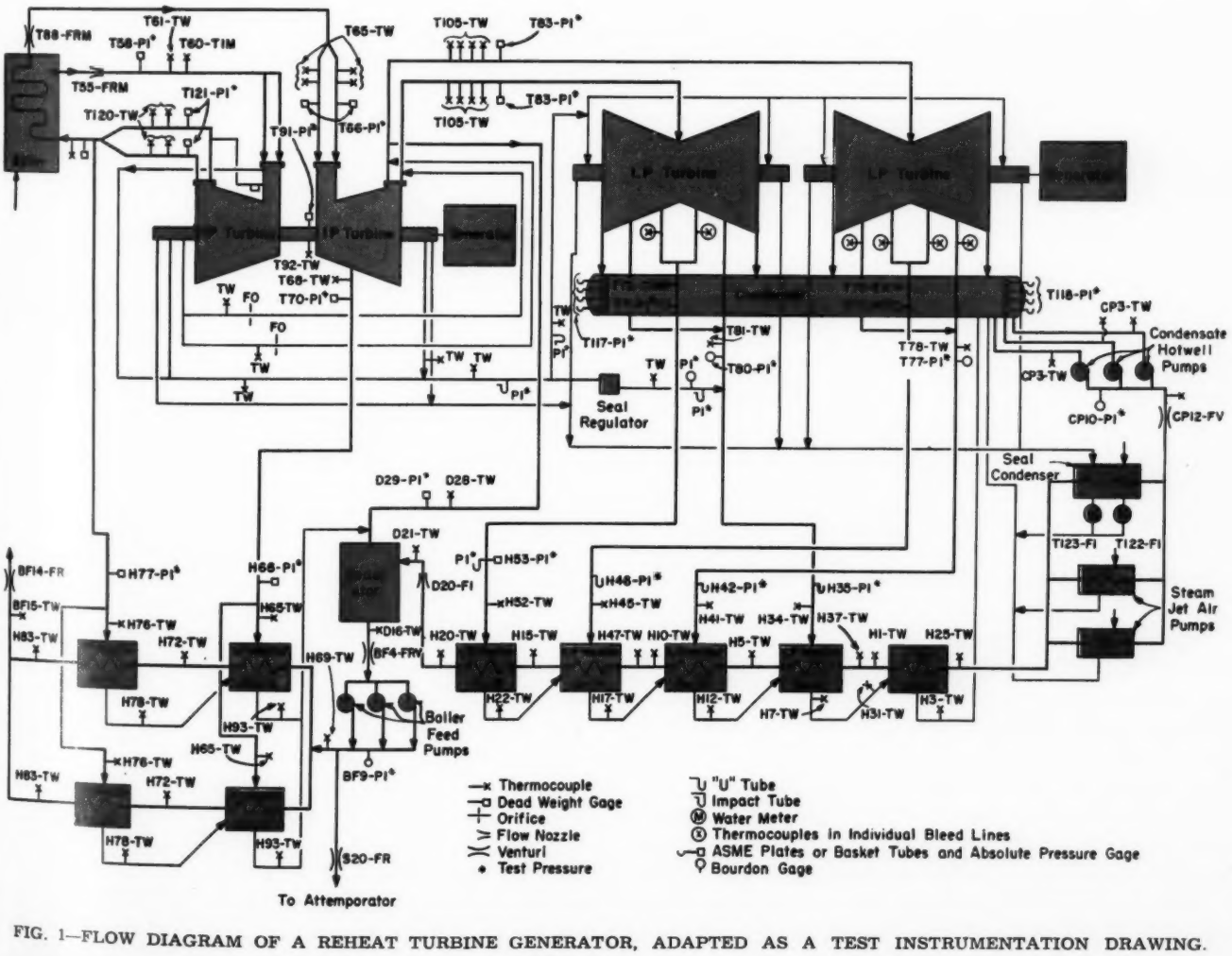

FIG. 1—FLOW DIAGRAM OF A REHEAT TURBINE GENERATOR, ADAPTED AS A TEST INSTRUMENTATION DRAWING.

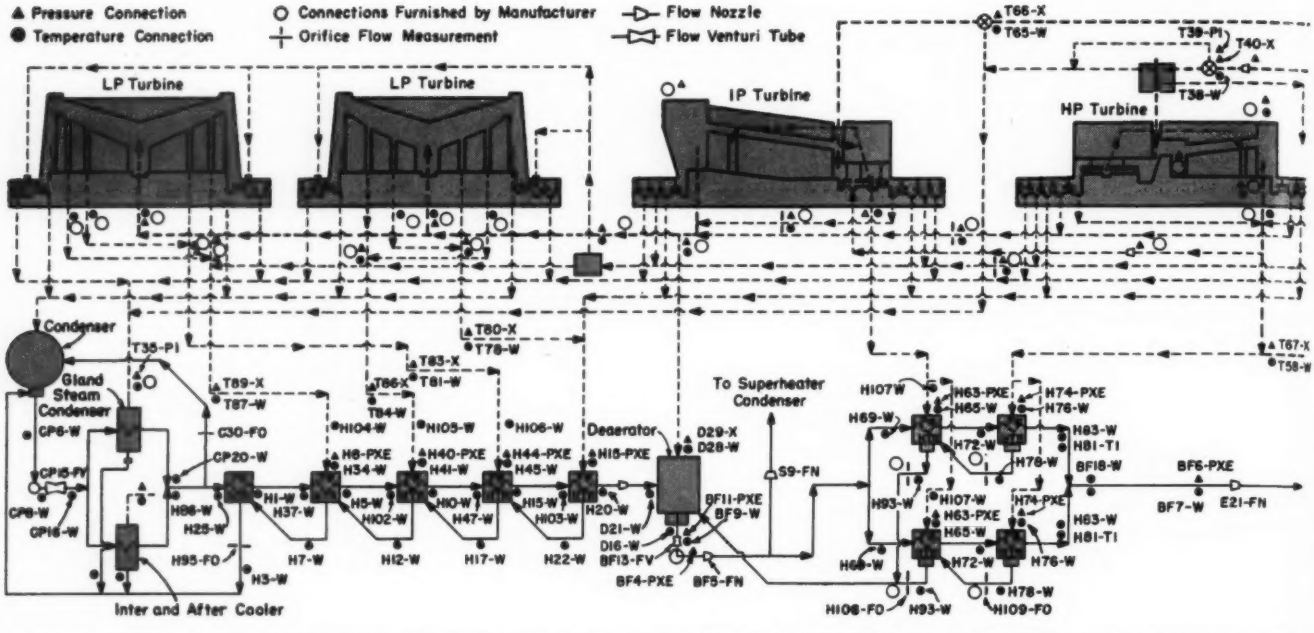

FIG. 2—TURBINE FLOW DIAGRAM SHOWING METHOD WITH ONLY SIX SYMBOLS TO REPRESENT TEST CONNECTIONS.

a second generator. In the steam cycle it will be noted that the steam leaving the high pressure turbine is returned to the boiler for reheating before being fed to the intermediate pressure turbine. There are four low pressure turbine bleed stages to as many low pressure closed feedwater heaters, and there also is a low pressure feedwater heater serving as the low pressure heater condensate drain cooler. A deaerating heater is employed, with its steam supplied from the crossover of the intermediate pressure turbine exhaust to the low pressure turbines. Also, some of the exhaust of the high pressure turbine to the reheater is bled off to supply a parallel pair of closed high pressure feedwater heaters, and a bleed stage in the intermediate pressure turbine supplies steam to a parallel pair of intermediate pressure feedwater heaters. (The condensate from the high pressure and intermediate pressure heaters is returned to the deaerator.)

In power plant parlance this diagram is known as a flow diagram. But a little study of it will quickly reveal that it is at one and the same time a block diagram in the language of the instrument and control field. Note that each turbine can be considered a block in the diagram, and the condenser is also a block. Also, it becomes quite obvious that each heater is one of the blocks in our block diagram.

As we further examine Fig. 1, we see in the legend some twelve picture type symbols to designate as many different types of measuring devices for temperature, pressure, and flow. These symbols are used on the flow block diagram at the location where a specific measurement is required for the test. Also, at each instrument connection location, a letter and numeral symbol will be noted. This is the instrument engineers' shorthand system for identifying the type and kind of measurement required. Several such symbol systems have been devised, and the information has been published.[1, 2, 3]

By referring from the letter and numeral symbols on the flow block diagram to the instruments and controls list, all pertinent data will be found tabulated. The list will show the instrument manufacturer, range, size, and type of connection, and it will list all detailed reference drawings.

Alternate Method for Turbines

In Fig. 2, we find another major turbine manufacturer's approach to the same problem. The turbine specifications, heat balance, and flow block diagram are approximately the same as in Fig. 1. Here only six pictorial symbols, to represent flow, pressure, and temperature measurements, are employed, and again, the letter and numeral symbols are used. This results in more dependence being placed on the letter and numeral symbols, and their explanation in the instruments and controls list, for instrument type and information.

Such symbolized flow block diagrams have proven an invaluable aid to test engineers in planning the items to be measured, in providing for connections for the measurements, and in determining that the measurements will be made with suitable equipment. Since all of the detail drawing numbers are tabulated in the instruments and controls list, it is a simple matter to refer to these drawings of each connection as required. Thus, working with the flow block diagrams in conjunction with the instruments and controls list makes all details of testing requirements and equipment available.

The same flow block diagrams also are reviewed for the Operating Department, and their requirements are marked on the diagram with the same picture symbols and letter and numeral symbols.

The operating instruments and the test instruments thus are superimposed on the one diagram. Since many of the instruments are used for both operation and test, duplication of connections and instruments is avoided.

Principle Applied to Boilers

We have seen how closely a flow diagram of a turbine can serve as a block diagram. The principle of block diagramming also can be applied to boilers.

To locate the instrument and control connections on a boiler, it is general practice to mark the requirements on the sectional views. As an example, Fig. 3 shows how one of the major boiler fabricators uses this method of showing the locations and types of connections for instruments used in operation and test as well as for boiler control connections.

Here again, just as on the turbine flow block diagrams, we find 13 different picture symbols used to represent as many types of connections. And once again we find each connection identified by a letter and numerical symbol based on the system described in I. S. A. Paper No. 53-10-2.[2]

It is not as easy to see how a boiler sectional view

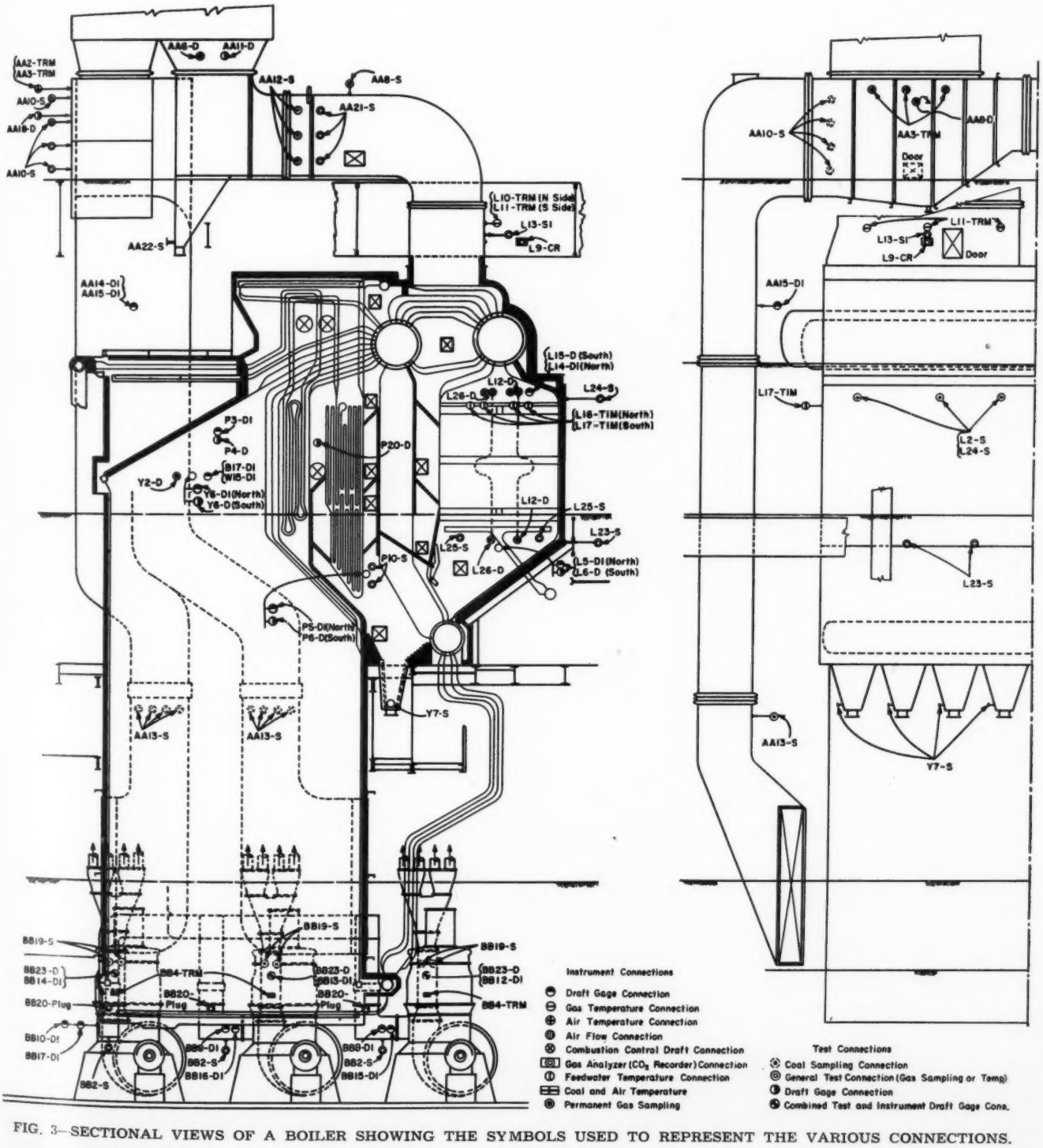

FIG. 3—SECTIONAL VIEWS OF A BOILER SHOWING THE SYMBOLS USED TO REPRESENT THE VARIOUS CONNECTIONS.

TABLE 1—INSTRUMENT CONNECTIONS

	Mark No.	No. Req'd.	Description of Service	Symbol Designation
Boiler Drum	1	1	Upper F.W. reg. (narrow range)	BD1-LI-HI
	2	1	Upper wide range level recorder	BD2-LI-HI
	3	1	Gage glass	BD3-LI-HI
	4	1	Gage glass	BD4-LI-HI
	5	1	Steam pressure gage	BD5-PI
	6	1	Remote trans. steam press. indic.	BD6-PXE
	7	1	Steam pressure gage	BD7-PI
	8	2	Gage glass - primary section	BD8-LI
	9	2	Gage glass - secondary section	BD9-LI
	12	2	Water sampling	BD12-S
	13	2	Water sampling	BD13-S
	14	1	Continuous blowdown	BD14-S
	16	1	Level indicator - upper	BD16-LI-HI
	17	6	Saturated steam sampling	BD17-S
	21	1	Lower F.W. reg. (narrow range)	BD1-LI-LO
	22	1	Lower wide range level recorder	BD2-LI-LO
	23	1	Gage glass	BD3-LI-LO
	24	1	Gage glass	BD4-LI-LO
	36	1	Level indicator - lower	BD16-LI-LO
	43	8	Peaned thermocouples	BD11-TRM
	44	4	Peaned thermocouples	BD11-TRM
	45	8	Peaned thermocouples	BD11-TRM
	46	4	Peaned thermocouples	BD11-TRM
Superheater	56	1	Gas differential draft gage	S6-DXP-LO
	60	2	Thermocouple connection	——
	61	1	Steam sampling	S1-S
	62	2	Test connection	S2-X
	63	2	Test well	S3-W
	64	4	Temp. instr. thermocouple conn.	S4-TRM
	65	2	Temp. instr. thermocouple conn.	S5-TXP
	66	1	Gas differential draft gage	S6-DXP-LO
	77	1	Gas inlet draft - test	S7-D
Reheater	79	1	Air flow - quick start	Q18-FKE-HI
	80	1	Gas differential draft	R10-DXP-LO
	81	1	Steam sampling	R1-S
	82	2	Steam sampling	R2-S
	83	2	Test connection	R3-X
	84	2	Temp. instr. thermocouple conn.	R4-TXP
	85	4	Temp. instr. thermocouple conn.	R5-TRM
	86	2	Test well	R6-W
	87	2	Test connection	R7-X
	88	2	Test well	R8-W
	89	2	Test connection	R9-X
	90	1	Gas differential draft gage	R10-DXP-HI
	93	2	Thermocouple connection	——
	94	2	Thermocouple connection	——
	99	1	Air flow - quick start	Q18-FKE-LO
	111	1	Gas inlet draft test	R11-D
	112	1	Gas outlet draft test	R12-D
Boiler	125	2	Gas differential draft gage	B5-DXP-LO
	126	2	Gas differential draft gage	B6-DXP-LO
	131	1	Furnace draft gage	B1-DXP
	132	2	Furnace draft test	B2-D
	133	1	Combustion control - draft	B3-DCE
	135	2	Gas differential draft gage	B5-DXP-HI
	136	2	Gas differential draft gage	B6-DXP-HI
	137	2	Inlet gas draft test	B7-D

	Mark No.	No. Req'd.	Description of Service	Symbol Designation
Economizer	165	2	Water outlet - temp. instr. T.C. conn.	E5-TRM
	168	2	Gas differential draft gage	E8-DXP-LO
	169	2	Gas differential draft gage	E9-DXP-LO
	176	2	Gas inlet draft test	E6-D
	177	2	Gas inlet draft test	E7-D
	178	2	Gas differential draft gage	E8-DXP-HI
	179	2	Gas differential draft gage	E9-DXP-HI
	180	2	Gas outlet draft test	E10-D
	181	2	Gas outlet draft test	E11-D
	182	4	Gas outlet - O_2 recorder conn.	E12-CXE
	183	4	Gas outlet - O_2 recorder conn.	E13-CXE
	184	4	Gas outlet - O_2 recorder conn.	E14-CXE
	185	10	Gas inlet sampling & test	E15-S
	186	8	Gas inlet sampling & test	E16-S
	187	40	Gas outlet sampling & test	E17-S
	188	24	Gas outlet sample - indicator	E18-SI
	189	8	Gas outlet sample - Orsat	E19-SI
	190	6	Ash sampling	E20-S
	195	10	Gas inlet sampling & test	E15-S
	196	8	Gas inlet sampling & test	E16-S
	198	8	Gas outlet sample - indicator	E18-SI
	202	2	Water outlet - test well	E22-W
	203	2	Water outlet sampling	E23-S
Air Ducts	211	8	Inlet air - temp. instr. T.C. conn.	A1-TRM
	212	16	Inlet air sampling & test	A2-S
	213	2	Air diff. across A.H.-draft gage	A3-DXP-LO
	214	2	Inlet air draft test	A4-D
	216	16	Outlet air - themocouple conn.	——
	217	16	Outlet air sampling & test	A7-S
	219	2	Burner air - draft gage	A9-DXP
	220	18	Burner air sampling & test	A10-S
	223	2	Air diff. across A.H.-draft gage	A3-DXP-HI
	228	2	Outlet air draft test	A8-D
	229	2	Sec. air duct - temp. instr. T.C. conn.	A26-TRM
Flue	231	18	Inlet gas - temp. instr. T.C. conn.	A11-TRM
	232	18	Inlet gas sampling & test	A12-S
	233	2	Gas diff. across A.H.-draft gage	A13-DXP-LO
	234	2	Inlet gas draft test	A14-D
	235	2	Outlet gas draft test	A15-D
	236	16	Outlet gas - temp. instr. T.C. conn.	A16-TRM
	237	24	Outlet gas sampling & test	A17-S
	238	2	Air flow draft test	A18-D-HI
	243	2	Gas diff. across A.H.-draft gage	A13-DXP-HI
	256	10	Gas inlet sampling	A25-S
	258	1	Flue press. - trip sw. (tee to A14-D)	A506-DAT
Desuperheater Condenser Piping	269	1	Water to desup. cond. - flow nozzle	S9-FN
	273	2	Water to desup. cond. - test well	S13-W
	275	2	Water from desup. cond. - test well	S15-W
	279	2	Water to desup. cond. - flow trans.	S9-FXE
	281	1	Water to desup. cond. - temp. instr.	S11-TI
	282	1	Water to desup. cond. - sampling	S12-S
	285	1	Water to desup. cond. - press. gage	S10-PI

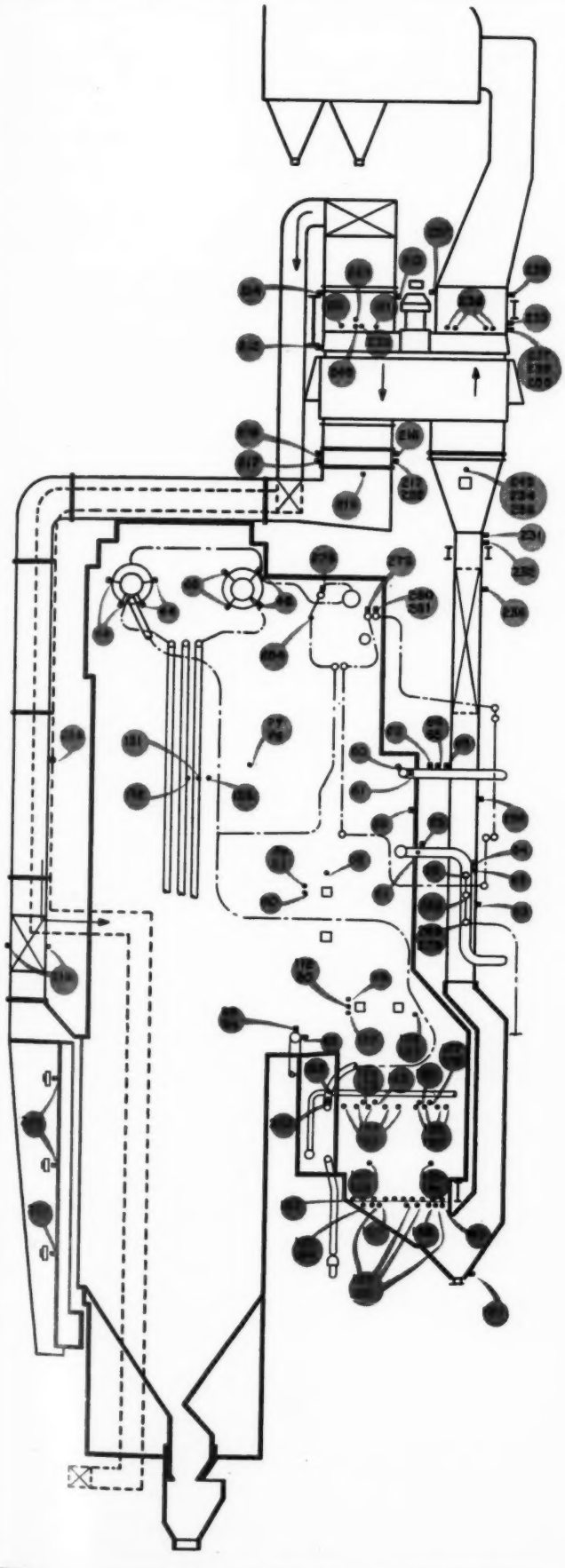

FIG. 4—SECTIONAL VIEW OF BOILER WITH CONNECTIONS IDENTIFIED BY NUMBER. TABLE 1 GIVES DESCRIPTIONS.

can be thought of as a block diagram. Nevertheless, with not too much imagination, we may consider each component of the boiler as a block, only lacking the actual outlines of the block. For example, the three mills can be taken as a single block or as three blocks (the fuel preparation block in this process). The furnace can be considered a block, and the superheater is another block. The economizer is still another block, as are the boiler drums. The air preheater is not included in this particular example but often is, and then it becomes another block. Similarly, when a boiler employs a reheater, that becomes a separate block. Imaginary lines must serve to outline these blocks on the drawing.

Number Identification

Finally, let us take a look at how another large boiler builder has applied such a system to show the control, operating, and test instrument connections on a modern large boiler. By looking at Fig. 4 we find that this particular boiler maker has elected merely to number each connection on the sectional views of the boiler. (Note that only one of several sections is illustrated.) The numbers on the sectional view are listed in the tabulation, Table I, which the manufacturer has prepared to identify the connections. The most noteworthy feature of this listing is the grouping of numbers in blocks, which have been assigned to the individual boiler parts, such as boiler drum, superheater, reheater . . . Here, the "blocking" previously referred to as imaginary is more realistically carried out in the instrument connections tabulation and greatly helps in visualizing these instruments as part of a block diagram.

It also should be noted that in the tabulation the numeral-letter symbol is listed for each connection.

In each of these examples, the same information concerning type and detail of connection and details of instruments can be obtained by reference to the instruments and controls list, as previously described for turbines.

While the illustrations used for this description are all power plant applications, they were chosen because they make it quite obvious that by using a bit of ingenuity and imagination, the block diagram method of analyzing instrument and control requirements can be extended to many processes not heretofore considered suitable for study by this means. ▲▲

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JOHN V. E. HANSEN

John V. E. Hansen received his B. Ch. E. from the Polytechnic Institute of Brooklyn, in 1949, and has completed graduate courses in chemistry, physics, and electronics. He also is a charter member of the Society of Technical Writers, and at present is national delegate and president of the Boston Chapter.

Currently Hansen is administrative assistant to the vice president in charge of research at National Research Corporation. Prior to this, he spent five years as a member of the Technical Publications Division of Jackson & Moreland, Inc. In his capacities as engineer-writer and engineer-editor, he completed many publication projects. One of his more interesting assignments was as member of a group that prepared detailed instruction manuals for the U.S.S. Nautilus, first nuclear powered submarine.

Getting More Service From A Technical Publications Staff

SEVERAL CONSULTING engineering firms now employ full-time technical publications staffs. In some organizations, such staffs have been established for more than 10 years, and there are many examples of recently formed technical publications groups. Although such staffs are set up to fulfill specialized needs, in many instances their services can be utilized on a broader scale. Furthermore, when you consider the background of technical publications, and the services available from a group of qualified publications personnel, you realize that there is a place in the majority of consulting engineering firms for a technical publications staff.

War Brought Change

Prior to the last war the technical publications profession was without identity. In many organizations the preparation of technical publications was considered one of several "engineering services." This type of thinking usually was reflected in the organization's budget, for few, if any, funds were allocated for technical publications.

World War II changed this philosophy drastically. During the war, industry made great advances in every field. Technological advances were particularly great, and the equipment coming off the assembly lines was more complex than ever before. At the same time, the armed services were swelled with untrained and, for the most part, nontechnical personnel. These factors combined to create an indoctrination and training problem of gigantic proportions. Lacking time and personnel, the armed forces relied heavily on technical publications to provide a solution. The majority of these publications were prepared by the equipment manufacturers. However, in some instances where consulting engineering firms were responsible for the design and prototype development of equipment, they were also responsible for furnishing the technical manuals. This pattern was repeated, with variations, during the war and, in several instances, was responsible for the establishment of technical publications staffs in consulting offices.

Medium of Communication

When the war ended, it seemed reasonable to expect that the situation would return to the pre-war condition. This, however, did not happen. Technological advances after the war were, in many fields, even greater than those made during the war. Furthermore, among manufacturers, technical publications were gaining acceptance as a valuable means of communication between management and designers, between designers and production personnel, and between the manufacturer and the consumer. Similarly, research and development organizations were depending more and more upon technical publications to serve as a communication link between various technical levels. Since communication is required in the consulting engineering field to the same extent, it is not surprising that some consulting engineering organizations have recognized the need for such work.

TECHNICAL PUBLICATIONS GROUP HANDLES REPORTS FOR FIRM AND DOES SPECIAL PUBLISHING ASSIGNMENTS FOR CLIENTS. PHOTOGRAPHS SHOW THE PUBLICATIONS STAFF AT ANDERSON-NICHOLS.

Today, the demand for technical publications is greater than ever before, and probably far greater than is generally realized. In the Federal Government fiscal year 1955-1956, between 3 and 5 percent (approximately $600,000,000) of the defense budget was allocated to preparation of engineering data in the form of publications and drawings. Recently, one of the nation's leading manufacturers conducted a bidders' conference for procuring quotations on technical publications work to be performed within the next six months. The total value of the work discussed was in excess of $2,000,000. Although this is an unusually large technical publications task, it is indicative of the growing need for technical publications.

From a personnel standpoint, the technical publications profession is coming into its own in a vigorous manner. Although job descriptions vary, advertisements for "technical writers" and "technical editors" appear frequently. Another indication of interest in the field is the growth of professional societies. The Society of Technical Writers, which was formed in Boston, in 1953, now has over 400 members and chapters in 14 cities. Other groups, such as the Association of Technical Writers and Editors, and the Technical Publishing Society, have had similar success.

Reasons for Growth

The reasons for the growth of the technical publications profession are many. Technical personnel are becoming more and more specialized, and technical publications are required to keep those specialists in touch with other areas that affect their work. Technical publications are often the primary link between research and administrative personnel; the latter must grasp the significance of technological advances in order to make the best decisions. The complexity of modern equipment, is, in many instances, so far beyond the intuitive comprehension of operation and maintenance personnel that detailed instruction manuals are essential. With the advent of automation, the operational problems are reduced, but maintenance problems assume great importance as a result of the complexity of these systems. In short, technological advances are increasing the need for communication between personnel of different technical levels, and between personnel in different technical fields.

The shortage of competent engineers and scientists also has had an important effect on technical writing. Many organizations have discovered only a limited number of engineers have a literary flair. Therefore, rather than try to make a mediocre writer out of every engineer, the approach has been to encourage the development of writing talent in a few engineers. By using these engineers as the connecting link between themselves and the technical publications, project engineers are free to devote more time to their basic problems, and the skilled engineer-writers produce a higher grade of technical publications.

Developing a Staff

Once an organization realizes that technical writing requires specialized skills, the development of a full-fledged technical publications staff is not unusual, for technical writers require many supporting talents to make their efforts worth while. Engineer-writers need engineer-editors to supervise and coordinate their efforts. Illustrators, artists and photographers are needed to supplement the written work with graphic presentation. Copy readers must proofread the text, and lay-out men must put the publication in an attractive form. All of these efforts must be supervised by personnel who are technically qualified and who have experience in publications and the graphic arts.

A management setting out for the first time to build a technical publications staff may be staggered by such personnel requirements. However, a little reconsideration probably will reveal that many of these talents are already within the organization and that even now they are being used for comparable tasks. Thus, the organization of a technical publications staff can be more of a consolidation of talent than a major addition of personnel. Under the direction of an engineer experienced in technical publications, a

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consolidation of this nature can be performed with little inconvenience.

Combined Responsibilities

In considering personnel for a technical publications staff, it should be realized that many responsibilities can be combined, thus reducing the number of persons required. Complete separation of responsibilities usually is necessary only in a large organization where the workload is sufficiently great to make efficient use of a large staff.

Another comforting thought to the principals of a firm with an embryonic technical publications staff is that help is always available in the form of outside organizations that render a complete technical publications service. At present, there are about 200 such firms in the country. The engagement of these firms to perform part of the work, or to assume complete responsibility in time of exceptional workload, is a practical arrangement for a company with a small technical publications staff.

A newly formed technical publications staff is apt to be the subject of careful scrutiny, as is any new investment. Here, however, the staff has only itself to blame if it cannot rapidly establish its value to the organization. Whatever the basic need that motivated its creation, there are many other ways in which a technical publications staff can render services to the parent firm of consulting engineers. Basically, a technical publications staff should be responsible for improving the quality of the technical publications that bear the firm's name. Where the responsibility for preparing reports for internal and external distribution falls to individual design groups in a consulting engineering firm, it is likely that such reports will vary in quality and appearance. Standardization is desirable, and the technical publications staff can take the first step toward improving the quality of the reports by designing an attractive cover that will serve for all reports.

Packaging the Report

The cover of a report warrants a little extra consideration for several reasons. For one thing, it is a a fine example of an area that often is neglected in technical publications. For another, you do not have to be a technical publications expert to appreciate the difference between an unimaginative cover and one that has an attractive and professional appearance. It is true that many engineering reports are destined for captive audiences in the client's organization and cannot always be classified as exciting reading. But this is not justification for making the report unattractive. There is always a possibility that an attractive report will be picked up by someone outside the captive circle — someone who will thus become familiar with the firm's activities. Then again, there is a psychological factor involved. A report cover that lacks any marks of professional preparation may prejudice the reader before he ever gets past the cover. Finally there is the question of identity. A client who has read many fine reports by a consulting engineering firm is justified in expecting that this level of quality will be maintained in all future reports. Thus, a distinctive cover is associated with a highly professional organization and is apt to receive special attention.

This is only one item of many that affect the quality of a firm's reports. Basically, the heart of the report is its content. If the facts are hidden in a morass of irrevelant information, or if the text is written so awkwardly that the full meaning is obscured, the report has failed in its basic task of communicating information. To the editors and writers falls the task of clearing away the literary deadwood. Some of these points are excellently discussed in recent articles. [1, 2]

Additional Assignments

Thus far, however, we have only considered reports. How else can a technical publications staff serve a consulting engineering firm? Consider the potential value of the illustrators on such a staff when a proposal is being prepared for a client. Consider a client who is interested in the construction of a processing plant and who must present a realistic and attractive proposal to the stockholders of his organization. On the basis of preliminary sketches prepared by the structural design group, the technical publications staff prepares perspective drawings showing the completed plant. By using airbrush techniques, the illustrators of the technical publications staff can create a photographic quality in the final product. This presentation permits the client's stockholders to see at a glance what their investment will represent, and the statistics and data supporting the proposal assume new meaning. Here the primary purpose of the illustration is to support and enhance data rather than to provide technical information.

For engineering studies in which a mass of technical data must be presented, the illustrators can make graphic presentations that will convey the desired information lucidly and attractively. A host of figures presented in tabular form is singularly unattractive when compared with a graphic presentation. Here the illustrators' imagination and ability serve to improve the presentation of technical data.

This random sampling of services offered by the illustrators of a technical publications staff provides some idea of the potential value of such a staff. Work ing with the illustrators, the technical writers can improve publications by reducing cumbersome verbiage to clear straightforward writing, by organizing the text so that the information is presented in as logical a manner as possible, and by taking advantage of the illustrating talent available to supplement the text with illustrations. All in all, the team of writers and illustrators offers a formidable combination for

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In considering the services available from a technical publications staff, thinking should not be limited to engineering reports, studies, and proposals. Clients sometimes ask that the end product — whether it be a design, the construction of a building, or a specialized study — be accompanied by a publication that is to receive wide distribution. A professional publication is required to match the professional level of the engineering work involved in the basic task. With a technical publications staff as part of its organization, the consulting engineering firm is in a position to offer the client a finished project.

When a client intends to prepare his own publications, the technical publications staff of a consulting engineering firm can be of value in collecting and presenting the source material the client will need. They lessen the client's work by providing the proper data in its most usable form. An obvious extension of this service occurs when the client's personnel are in a peak load condition, and therefore can handle little or none of the publication to be produced. The consulting engineering firm is then in a position to prepare as much or as little of the publication as the client may wish, making it possible for the client's staff to continue the work as soon as the peak load condition passes.

Direct Service to Clients

In reviewing the role of the technical publications staff, the accent has been on a supporting service rather than an independent one. Although a publications staff may originate as a supplementing service, there is no reason that it cannot serve clients independently. In at least one organization, the technical publications division spends less than 10 percent of its effort in support of the other divisions of a 500-man consulting engineering firm; the remainder of its time is consumed by projects conducted independently for external clients.

To appreciate the independent activity of such a staff, consider a few of the projects that have been completed by technical publications organizations. On the basis of a nationwide survey, an association of power transmission equipment manufacturers determined that a basic manual covering their type of equipment was needed to supplement engineering texts in use today. The technical publications group of a consulting engineering firm, with minor aid from design engineers active in the field, wrote, illustrated, and produced the final publication. On another occasion one of the armed services required, for nontechnical personnel, a publication that was to include a presentation of transonic and supersonic aerodynamic effects on various aircraft configurations. An authority in the aeronautical engineering field was employed as a consultant to supplement the technical background of the various engineer-writers. This consultant's contribution was less than

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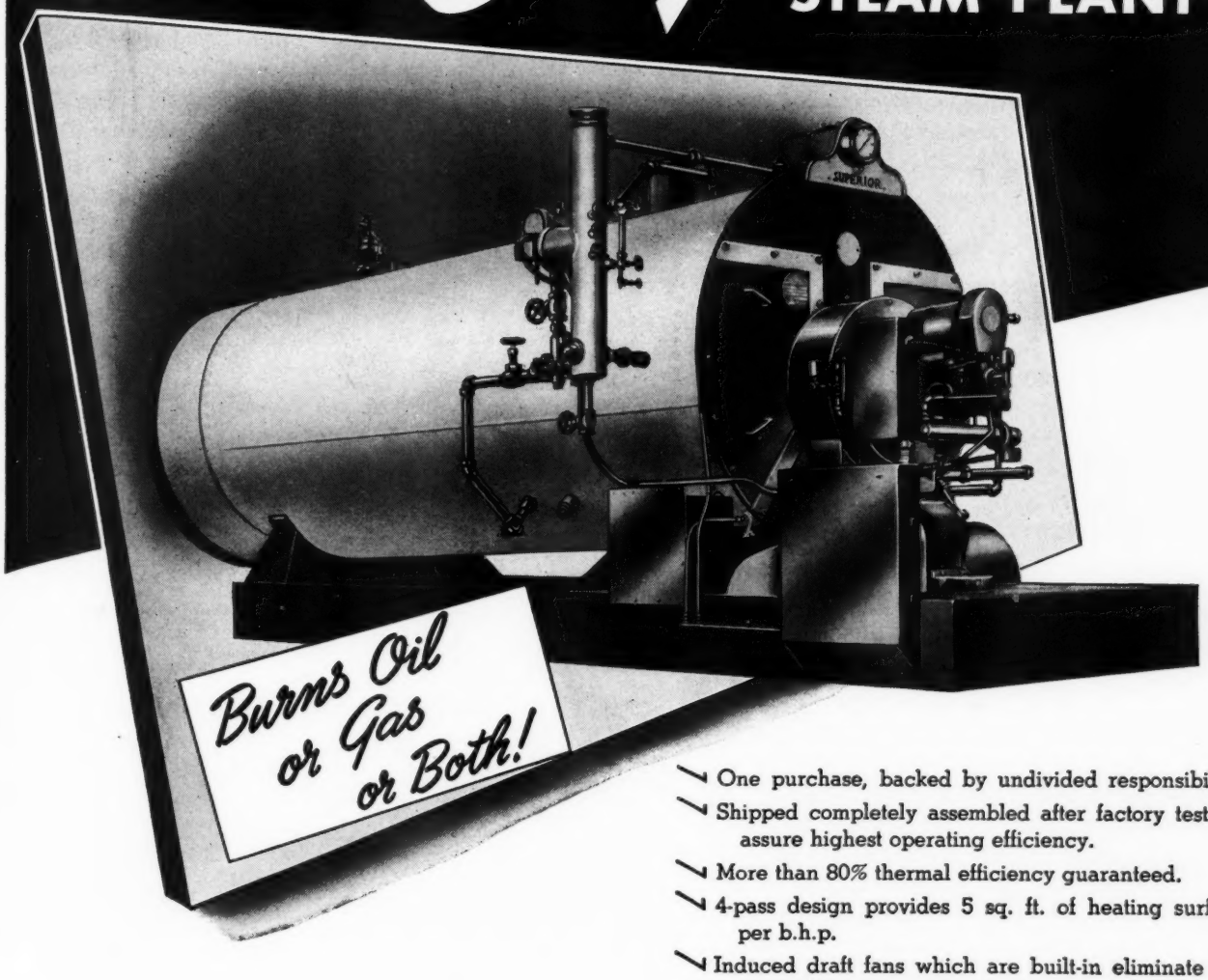

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two percent of the total manhours required for the project. The remainder of the time was utilized by technical publications personnel to translate complex technical information into text and illustrations for nontechnical personnel.

Another and more recent example of the activities open to a skilled publications group is in the field of human engineering. A publication is being prepared giving the results of basic physiologic research in such a way that the physiological capabilities and limitations of those using the equipment could be incorporated in the design of the equipment. This project is being conducted by a technical publications group in conjunction with an organization equipped to perform applied research in this field, and the two complement each other ideally for the task.

In reviewing these projects, the need for specialists to supplement the engineer-writers becomes apparent. However, in a large engineering organization such specialists are frequently available. No outside consultants are needed, and the parents firm can offer these services as an added advantage.

The projects described offer some indication of the ways in which a technical publications staff can offer independent rather than supporting service. Regardless of the type of service offered, there are other advantages to having such a staff as part of a consulting engineering firm.

The wide range of projects handled by a technical publications staff provides a valuable source of information for other divisions of the firm. This information may range from data regarding prospective clients to engineering developments that will assist other divisions of the firm in evaluating new projects. A technical publications staff also can serve as an effective device for obtaining new business. Clients served independently by the publications staff become familiar with the other activities of the firm, and potential clients are developed.

There are undoubtedly other ways in which a technical publications staff can serve a consulting engineering firm. The basic need, however, is for a professional approach to the problem of communication. There are many examples[3] of concerted efforts being made by firms to improve their publications, and it would be reasonable to expect this trend eventually will result in formal organizations of qualified technical publications personnel within consulting engineering firms. ▲▲

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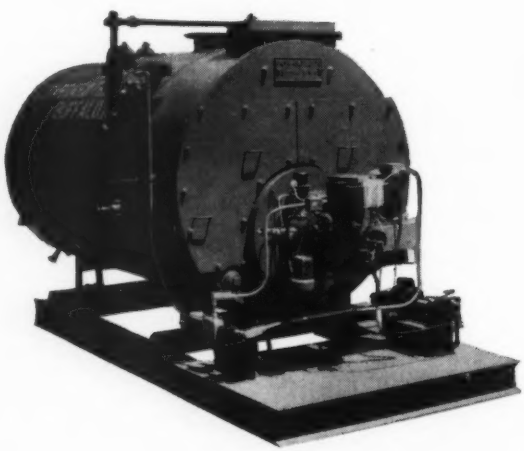

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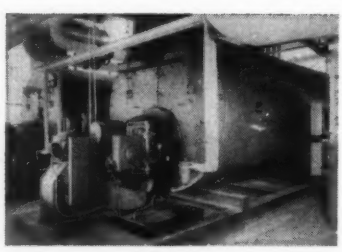

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STAFF REPORT

EACH MEMBER of the New York Association of Consulting Engineers, during the past 30 years, has prepared his own supplementary Mechanical and Electrical General Conditions and used these in conjunction with the American Institute of Architects "General Conditions" when preparing specifications and plans. During the past two years a committee of the NYACE has reviewed these many individually prepared supplementary conditions and has taken the best from each to compile a set of General Conditions which apply to all mechanical or electrical work in buildings. Now, the electrical or mechanical engineer can attach a copy of these General Conditions as a supplement to the AIA's "Contract for the Construction of Buildings" and be sure that he is properly covering all conditions vital to the proper relationship of contractor, client, architect, and engineer.

There is a strong trend toward the use by engineers of tight specifications in which every item specified is described in detail and the manufacturer's name and catalog number is shown. And, engineers are more often writing their specifications without the phrase "or equal." In other words, the specific product is designated, and the contractor can in no way deviate from the specification except with the approval of the engineer and architect.

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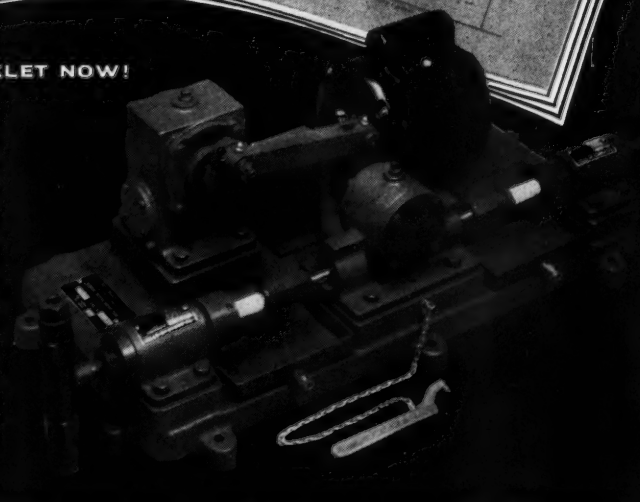

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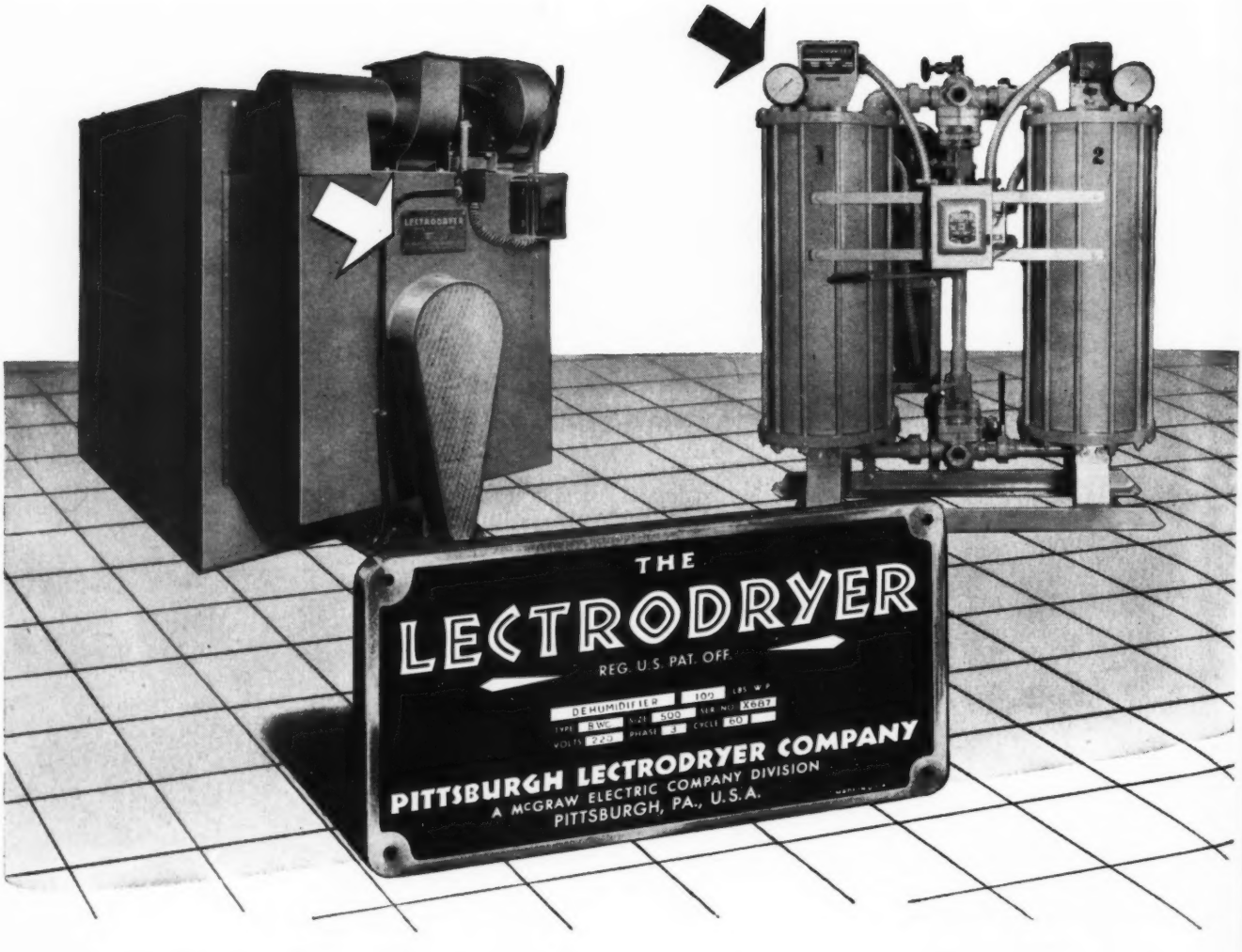

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York Association of Consulting Engineers take into account this increased use of the Base Bid Specification. However, the conditions are written in such a way that they can also be used with Open Specifications, such as are so frequently required in Federal Government Work, or with Bidder's Choice Specifications, as required for most state and city public work — and as preferred by some private clients on certain projects.

Equipment Deviations

On this subject of equipment deviations, the New York General Conditions have this to say:

"The plans and/or specifications indicate the name, model number, or type of the equipment or materials to be used as a standard for the contractor's proposal. All bids shall be based on the equipment and materials specified. Should the bidder desire to use equipment or materials of a make other than those specified or shown, he shall attach a rider to the bill form listing the deductions and/or additions to his base bid, together with the manufacturer's names and model numbers of the equipment or materials he proposes to furnish as 'substitutes.' If no substitute information is furnished it will be expressly understood that all equipment and materials named will be furnished in full accordance with the plans and/or specifications."

This same section of the General Conditions goes on to state that where a contractor plans to use equipment other than that specified he shall prepare and pay for all cost in connection with redesign brought about by the change. Also, where approved deviation requires a different quantity and arrangement of equipment, the contractor must furnish and install all such equipment at no additional cost to the owner.

A Question of Intent

Under the subtitle "Intent" the General Conditions call attention to the responsibilities of the contractor. It is stated that the intention of the specifications and drawings is to call for finished work, tested, and ready for operation. The following paragraphs in that section make it clear that the contractor is responsible for furnishing and installing all incidental accessories necessary to the completed job and that is is understood that the contractor has included the cost of all required items in his proposal on the job.

This is an important part of the contract, for many contractors have made it a practice to bid low in order to get the job and then to claim the need for payment for extras not specifically covered in the plans and specifications.

It is not uncommon, for example, to find that in the preparation of many sheets of plans, the engineer's draftsman may inadvertently omit a line on a drawing indicating a connection between a lighting fixture and its switch. Contractors have been known to call attention to such minor inadvertent omissions and claim that their bid did not include the cost of that wire and its installation. By searching for this type of detail, a contractor can considerably increase the cost of a job and place the responsibility on the engineer.

The insertion of these paragraphs on intent reduce the danger of having to put up with this type of nuisance.

Of course, this does not mean that the engineer can make incomplete plans and specifications and expect the contractor to take responsibility. In fact, the New York City Housing Authority has added a new clause to their standard contract with architects — and hence with the engineers working for architects — stating that "The architect shall apply to the preparation of the plans and specifications the reasonable and proper skills, judgment, and care which are customary and normal to professional architectural practice, and shall be liable to the Local Authority for damages or losses resulting from failure to apply the above reasonable and proper skills, judgment, and care."

Engineer's Responsibility

No engineer wants to escape his rightful liability, but, on the other hand, he does expect the contractor to include in his estimate the minor details not usually shown on plans or specified but obviously necessary for completion of the project.

It is felt by members of the NYACE that the use of these General Conditions as prepared by their committee will greatly strengthen the position of the consulting engineer and the architect by whom he is engaged in all of their relations with contractors. These conditions are also excellent protection for the owner in that they clearly eliminate the opportunity for many of the sharp practices of some less scrupulous contractors.

These General Conditions contain twenty-two standard articles covering in considerable detail the contractural obligations. There are also eight elective paragraphs that can be included in the General Conditions wherever they are appropriate.

Any consulting engineer interested in studying these General Conditions can secure a copy by writing to the secretary of the NYACE, Room 1910, 220 East 42nd St., New York 17, N. Y.

Missouri Association Code

The Missouri Association of Consulting Engineers has also been at work on a publication designed to establish better working relations between electrical contractors and consulting engineers. Where the New York General Conditions are aimed primarily at defining and specifying the duties and responsibilities of the contractor, the Missouri Association "Code for Preparation of Electrical Plans

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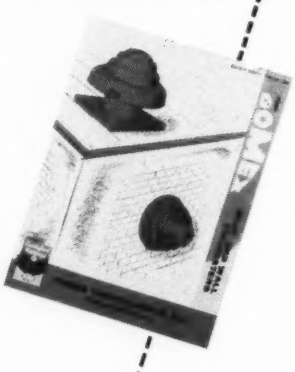

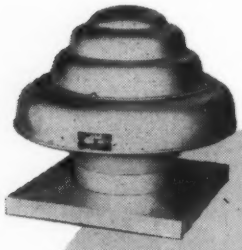

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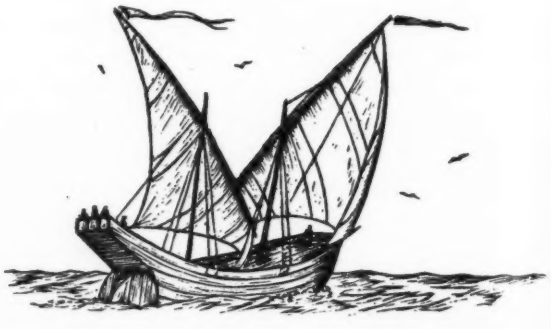
and Specifications" approaches the relationship in a different way. This Code is drawn up as more of a set of instructions to consulting engineers and defines their duties and responsibilities in connection with the plans and specifications to be provided the contractor.

In discussing plans, for example, the Code states that the scale of working drawings is to be uniform and not less than ⅛-in. to the foot. Symbols should be explained on the plans and should be in agreement with standard electrical symbols. Sectional drawings or congested areas should be made to show all mechanical and electrical trades where interferences occur.

The Code goes on to state that on all complicated projects there shall be separate electrical drawings which shall include the outline drawings of major items of equipment of the other trades. All control wiring included in the base bid or alternate shall be shown on the plans or be specified except on simple control wiring normal to usual installations of that equipment.

This Code then goes into considerable detail as to the way in which the consulting engineer shall make his plans so that they can be easily understood by the electrical contractor. Where discussing specifications, the Code states that specifications should be exactly written on all materials and equipment and should be rigidly enforced. Furthermore when special or uncommonly used equipment is specified, the manufacturer's name should be given with his local address.

While approaching the engineer-contractor relation in quite a different manner from the NYACE's General Conditions, there is no doubt but that many consultants could improve their relations with contractors and enhance the value of their engineering work if they were carefully to follow this Code prepared by the Missouri Association. Copies are available by writing to the Secretary of the Association, at 1350 Syndicate Trust Bldg., 915 Olive St., St. Louis 1, Mo. ▲▲



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——See page 136

Powell Lubricated Plug Valves

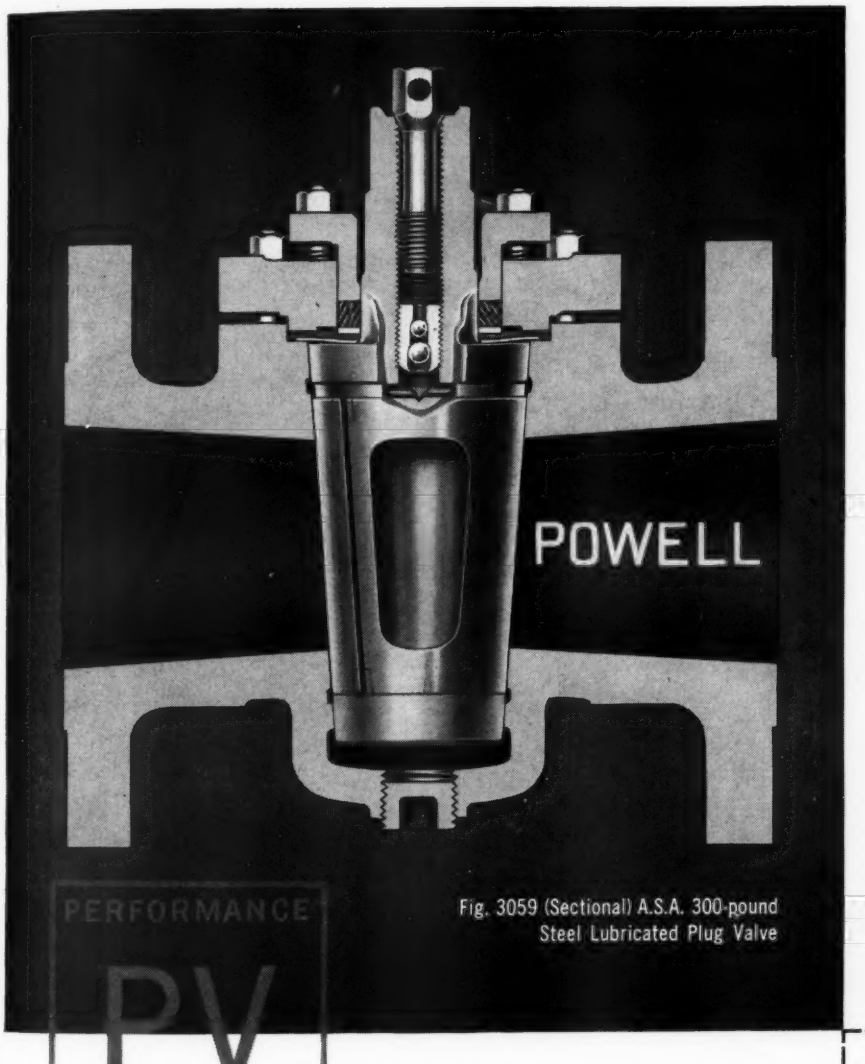

Fig. 3059 (Sectional) A.S.A. 300-pound Steel Lubricated Plug Valve

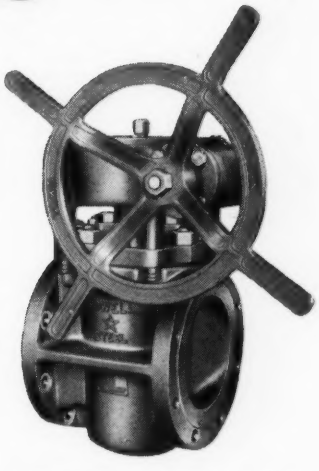

FIG. 1559G—150-pound Steel Lubricated Plug Valve. Gear operated

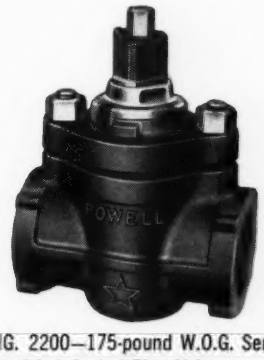

FIG. 2200—175-pound W.O.G. Semi-Steel Lubricated Plug Valve

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Report From India

S. S. PANI
CONSULTING ENGINEER CORRESPONDENT

BEFORE INDIA separated from Great Britain, consulting engineers were practically unknown in India except for a few civil engineers who were also architects. These were mostly superannuated engineers who had retired from Government service and who wished in the evening of their lives to turn into good account the experience they had gained while in service.

Scope of activity was extremely limited. The average Indian, interested only in building a house or shop for himself, never stood in need of the services of a consulting engineer. He followed traditional methods. The builders of ancient India had their own authorities for guidance, and rarely was a building of more than three stories projected.

During the days of British rule in India, this country was nothing more than a vast reservoir of raw material, and there were no industries worth mentioning. There were a few textile mills and a few sugar factories, mostly British-owned, and designed and erected by British consulting engineers. Indian-owned units were built "some how" and they were uneconomic, hazardous adventures producing goods of low quality in poorly constructed buildings.

In the public sector, railways and the generation of electric power were either in the hands of Government or British corporations, which invariably employed British consulting engineers who seldom cared to establish themselves in this country. Buildings for Government use were modeled after those in the United Kingdom, with scarcely any opportunities for work by the Indian engineers. As a matter of fact, Indian universities turned out personnel fit to fill only subordinate ranks and clerical jobs.

In those circumstances, the Indian consulting engineer was a superfluity and any person who attempted to set up as one would most certainly have had to pull down his shutters after a short try.

There were a few British architects who depended for work on British commercial interests, which fluorished under British rule. With the switch of power into Indian hands, most of them pulled out under the mistaken notion they would be unwanted by Indian India. The few that preferred to stick on are now functioning either as they were or in association with Indian partners. They are doing well, as the ties between India and Great Britain are still remarkably cordial, and they are engaged whenever the Government has to put up large buildings. Strictly Indian talent of that order is not available and, as in the days of the British, the man on the spot is favored. In fairness, it should also be stated that the British architect continues to maintain a high degree of excellence and efficiency.

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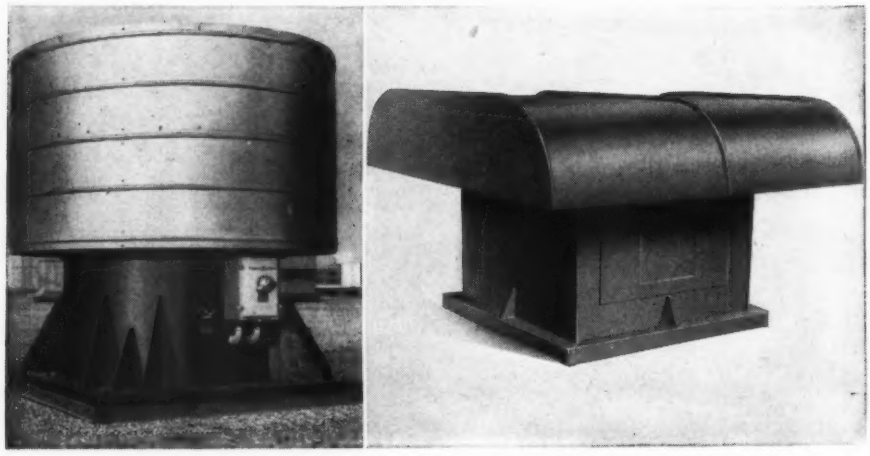

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Complete unit with fan in stack, shutters, integral flanged curb plate and internally braced heavy-gauge galvanized steel hood.

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Extremely heavy-duty with welded steel plate gussets supporting motor and propeller fan. Counterbalanced dampers in cylinder open when fan starts, close when it is stopped. Integral flanged curb plate simplifies installation.

CAPACITIES: 1,000 cfm through 250,000 cfm
SIZES: 12" through 120"

**The "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life.*

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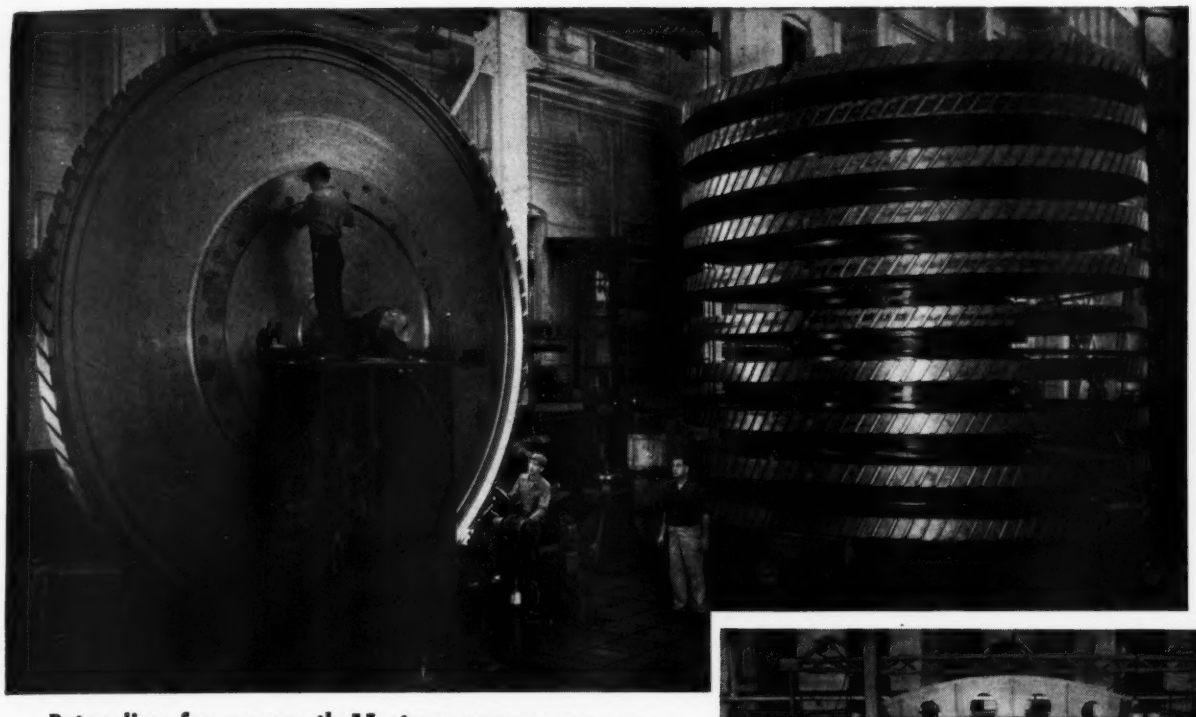
INDUSTRIAL EXHAUSTERS BELTED VENT SETS PROPELLER FANS "E" BLOWERS-EXHAUSTERS

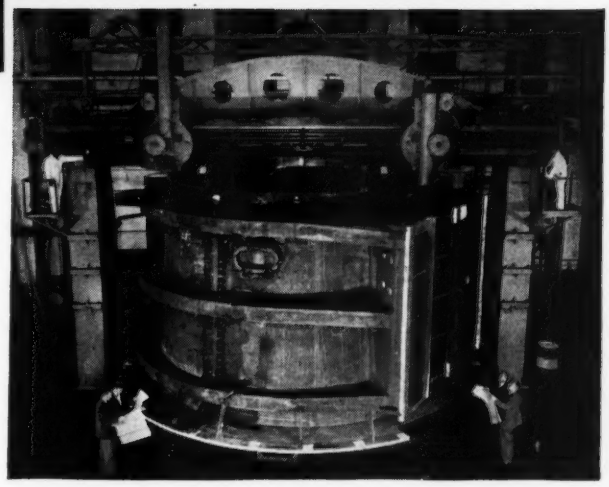
and private sectors, mainly as the result of the first Five-Year Plan which is nearing completion, and the second Five-Year Plan which is about to start, involving an outlay of 28 billion rupees, roughly $6 billion.

The trend in the establishment of new industries has been to go in for "package jobs" where a foreign manufacturer undertakes to design, supply machinery, and erect a factory, which is handed over to the owners in working condition. Two considerations have influenced both Government and private industrialist in having recourse to "package jobs," and the fallacy is always there that fee for a consulting engineer is saved. The first so-called advantage is that no one need bother his head over implementation of the project, as the foreign principal undertakes responsibility from A to Z. Secondly, in the absence of Indian experts who could scrutinize reports of foreign consulting engineers, it is held that engaging such engineers results in abdication of all rights in their favor—while getting a job done by a foreign firm with an established reputation is much safer. As a result, almost all the jobs under the first Five-Year Plan were done on the "package" basis—but results have been far from satisfactory. To cite instances, the project for prefabricated houses entrusted to a Scandinavian firm proved an abject failure. Another plant for the production of small arms entrusted to a Swiss firm has been the target of bitter criticism in Parliment, ministerial benches blanching under a devastating fusillade of questions. As regards the Integral Coach Factory, in Madras, for the production of rolling stock for railways, Comrade Khruschev from Russia, during a personal inspection, complained of a deplorable waste of cement and made his criticism stick. This factory is also fathered by a well known Swiss firm. This trend, it is feared, will continue until India is educated to the role played by the consulting engineer.

India today is primarily interested in developing her water supply resources and power-generation potential. Construction of huge dams seems to answer both



Rotor discs for mammoth 11-stage compressor were balanced and stacked for alignment in one of Newport News' five huge machine shops. Large engineering and technical staffs with a vast plant make Newport News an ideal source for large equipment . . . *standard or special in design.*



A 35-foot boring mill in Newport News' plant machining the 374,000-pound upstream housing for the giant axial flow compressor. The compressor is heart of an 8-foot supersonic wind tunnel at the Ames Aeronautical Laboratory of the National Advisory Committee for Aeronautics at Moffett Field, Calif.

To create winds exceeding

2000 MPH

Newport News builds world's Mightiest Compressor

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This company recently built an eleven-stage axial flow compressor that shatters all previous records for wind force . . . using what is believed to be the world's largest rotating object.

The rotor, weighing more than 400 tons, comprises eleven huge discs. Each disc, machined from a 96,000-pound forging, was finished to a 50,000-pound wheel and balanced to within 26 ounces at the rim. In each rim, slots for blades were machined to within .005″ on special milling heads designed and produced in the Newport News plant.

Here at Newport News, you'll find more than large productive capacity. In machine shops, foundries and forging plants Newport News craftsmen complete your orders with specialized techniques backed by experience in fabricating thousands of products.

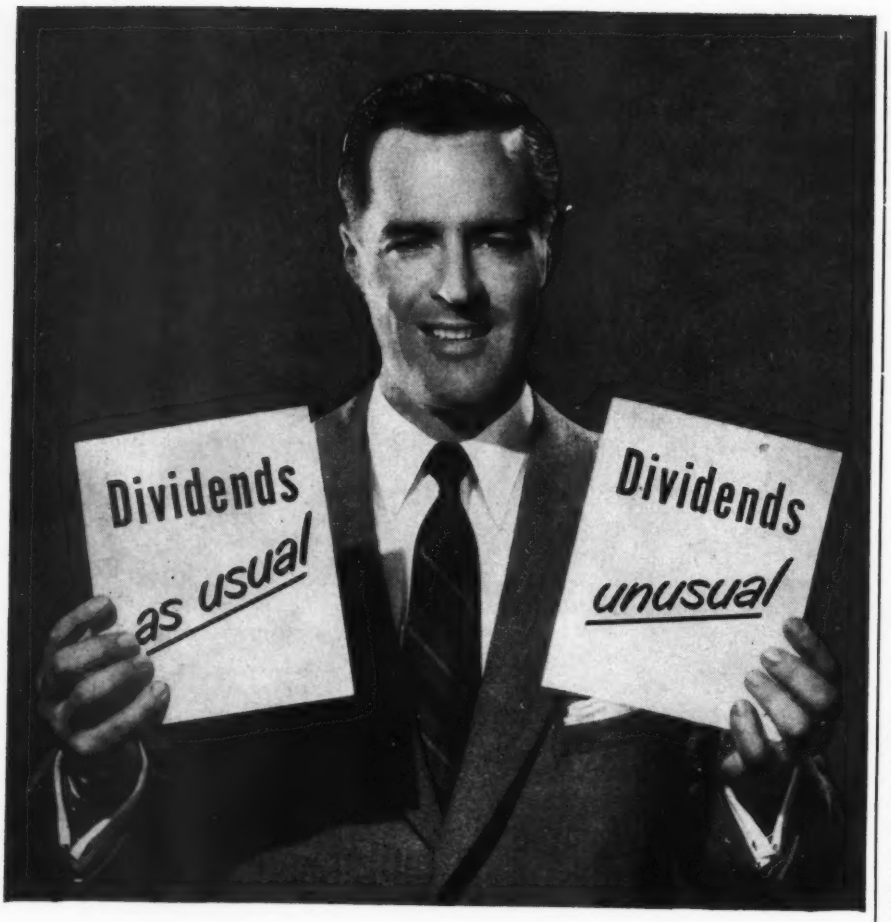
Newport News' craftsmen produce units that range from small components of spinning machines, to mammoth hydraulic turbines . . . from piping, pumps and valves, to vacuum tanks, digesters and bridge caissons.

These skilled men handle the job exactly as you want it done, for maximum results per dollar invested. So let us bid on your present or future projects. Learn how Newport News can help you. Send for our illustrated booklet entitled, "Facilities and products" . . . it's your for the asking.

Newport News

Shipbuilding and Dry Dock Company

Newport News, Virginia



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needs, and in order that these dams may be built to good purpose, leading engineers in Government service were sent to visit the TVA projects in the U.S. While in the days of the British, major dams such as the Sukkur Barrage and the Mettur Dam were built by British engineers, today these are designed by Indian engineers in Government service, who have had the benefit of studying various TVA methods at first hand.

Alongside the American Technical Cooperation Mission, other European countries also have volunteered technical assistance to India, and services of technical experts are secured by private clients from these missions. Again, when Indian principals promote a new industry, they work in association with a foreign principal already in the field, and he undertakes to provide the technical knowledge. This is particularly true in the automobile industry, where Standard Motors and Leyland Motors, of Great Britain, and Mercedes-Benz, of Germany, are collaborating in the production of motor cars and trucks on a phased program. The impression in India is that General Motors and Ford refused to convert their assembly plants into manufactories, and had to close down.

It is felt that a corps of Indian consulting engineers, in the full sense of the term, will not come into existence until India has had her new industries functioning for some time. Until that time it is felt that the "package" job even with its handicaps, is the only answer for the development of Indian industries.

There is one exception, and that is the establishment of oil refineries where the Government of India had to enter into secret pacts with foreign oil interests to induce them to build refineries in this country. Standard Oil and Burma-Shell have their refineries already functioning after entering into such agreements, and a third plant by Caltex, is in the process of erection. For all these projects, Lummus have been and are acting as consulting engineers.

Those firms in India that call themselves consulting engineers are mostly architects. Excepting

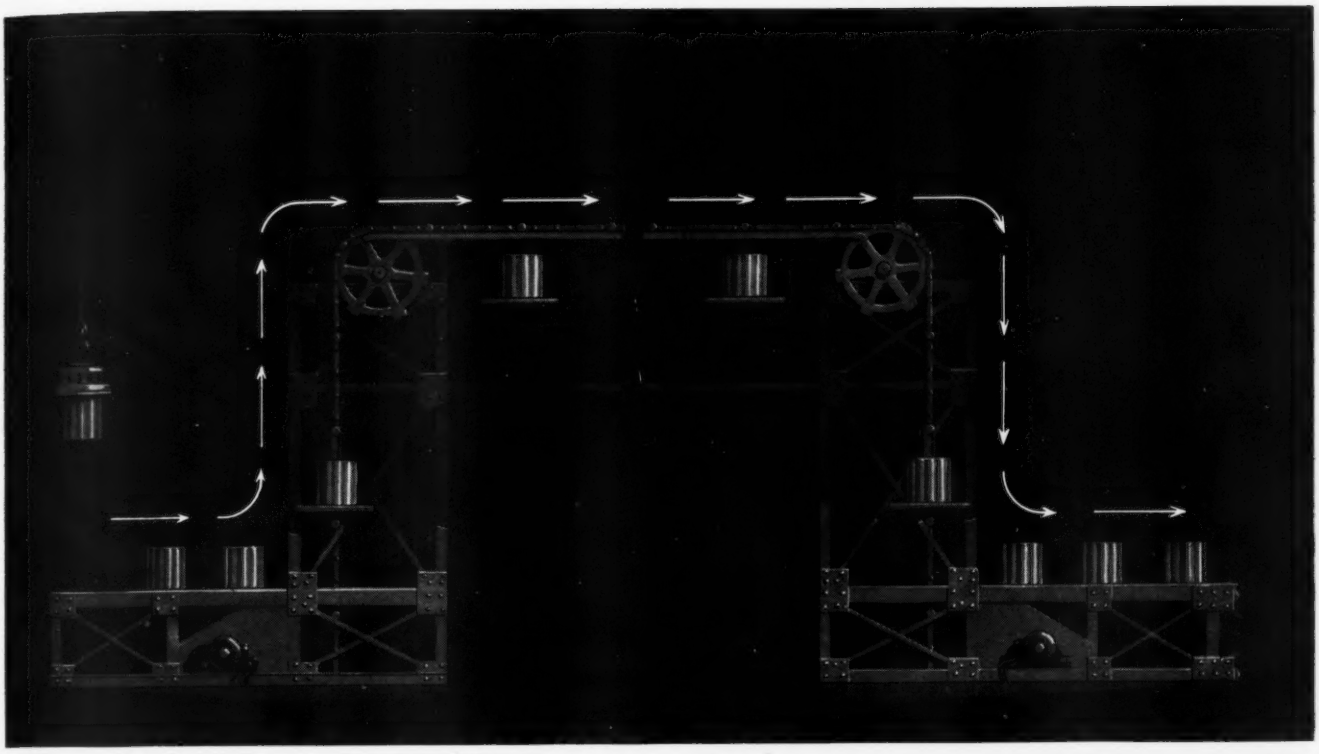
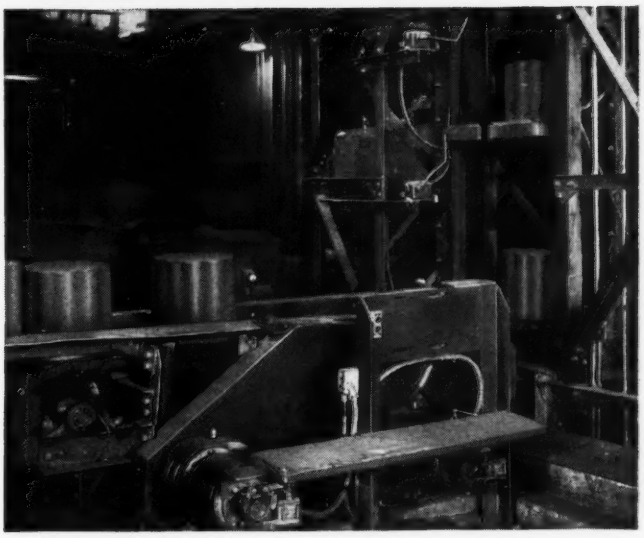


Diagram of the JEFFREY continuous automatic ingot conveyor system at Standard Steel Works Division, Baldwin-Lima-Hamilton Corporation, Burnham, Pennsylvania.

75% saving in handling



Ingots start their trip to the rolling mill here. No more delays for batch-loading onto flat cars.

credited to this JEFFREY Conveyor System

Rising vertically for 20 feet, leveling off to a 25° incline across railroad tracks and a road, horizontally for another 57 feet, then descending to the receiving station—that's the aerial route taken by this JEFFREY conveyor. Transfer time, 3¼ minutes. Distance traveled, 168 feet, compared to a mile when railroad cars were used for this task.

Little labor is required, since a spring-mounted gravity roller conveyor automatically feeds the one-ton ingots to the chain gathering conveyor. The tray conveyor picks them up there and carries them to the rolling mill, where they travel past the weighing station on chain conveyors to the unloading point.

There's considerable saving, too, on badly needed storage space. Ingots move away at a rate of four per minute, so they don't pile up in the open hearth shop.

Write for catalogs containing complete information on JEFFREY handling equipment. The Jeffrey Manufacturing Company, Columbus 16, Ohio.

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a very few of these, they are said to copy from or adapt blueprints obtained from foreign sources in designing new buildings. Buildings taller than ten stories are just now being built and one of them, in Madras, is to house an insurance firm, which has since been taken over by the Government of India. At the time of driving piles for the 14-story structure, vibration caused the walls of an adjacent bank building to crack; the problem of compensation for the bank still exists.

These "consulting engineers" set their fees on a percentage basis, which is generally five percent of the estimated cost. But such projects are so few and there is always cut-throat competition, which results in the reduction of the fee to as little as one percent. It is also widely known, especially in Bombay and Calcutta, that these "consulting engineers" enter into private and unwritten arrangements with contractors for secret commissions, and they are always willing to turn their Nelson eye towards inferior quality materials and workmanship.

Foreign firms who undertake to do "package jobs" not only have their margin of profit for the machinery they supply but are also understood to charge special prices for "special equipment" supplied by them. In addition, they are entitled to charge for the experts they send to this country.

While there is no association of consulting engineers in this country, there are various "Institutes of Engineers," which accept as members those who have university qualifications. A couple of years ago, there was a move to organize an association of consulting engineers with the sponsor making out a formidable case against "package jobs," but the move ended with no results. To all intents and purposes, unless the Government gives up entering into agreements for "package jobs," opportunities for the independent consulting engineer are few.

Although every university in India confers degrees in engineering—civil, mechanical, and electrical—there is no statutory ban on any individual setting up as an engineer. Such a person cannot aspire to do work for Government

or large industrial undertakings, but the average Indian, proposing to build a house for himself, seeks the services of such people, as their fees are very cheap. Competition is so acute that even the qualified engineer looking for private patronage has to lay aside his scruples if he is not to starve. And the best known film producing studio in this country, located in Madras, and reputed to be the best this side of the Suez, was built without any technical assistance!

Local engineers do not have any accepted code of ethics, as it is always a case of "every man for himself . . ." Generally speaking, Indian consulting engineers do not advertise; not because they are ethically against doing so, but because advertisement would serve no useful purpose. However, when a new project—perhaps a building—is completed, newspapers, for a consideration, issue special supplements in which, among other advertisements, consulting engineers are also lauded.

On some projects, the Government, in addition to supplying copies of designs, gives contractors the option to submit their own designs. This would require every contractor to engage a consulting engineer with no guarantee that his design would be accepted. In event of rejection, the tenderer is clearly out of pocket to a considerable extent, and no one therefore thinks of submitting designs.

Recently a ten-story building for the Indian Chamber of Commerce, was built in Calcutta. Writing of the building, the Chamber says assistance from America was obtained in designing the building, and Mr. William Lescaze was associated with the project. This is the one known recent instance where the assistance of an American architect was sought.

It would be wrong to suggest that the consulting engineer has no future in this country. Foreign firms who have done some bit of work or other in this country are aware there is a bright future, maybe twenty years hence, and they are absorbing Indian engineers in their organizations on a liberal scale so that when the occasion comes, they can lay emphasis on the Indian aspect of their organization. ▲▲

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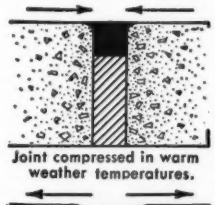
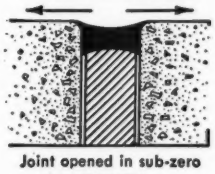
★ Keeps joints sealed under severest conditions of Traffic and Temperature

★ Pumped directly into joint from melting kettle


Joint compressed in warm weather temperatures.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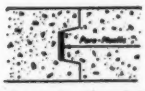
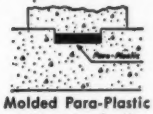
For sealing keyed construction or contraction joints in vertical walls. Maintains bond with concrete at temperatures to sub-zero. Simple installation insures a moisture-tight seal of the joint.


Keyed construction joints in vertical walls and horizontal slabs.


Molded Para-Plastic sealing at a footing.

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Hagan Ring Balance Meter integrates data used to compute charges for air conditioning of Gateway Plaza Restaurant at Gateway Center, Pittsburgh

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- *For a central air-conditioning plant,* it measures the exact amount of cooling supplied to each customer, at the same time computes how much each is to be billed.
- *For utilities and their customers,* the Hagan Ring Balance Meter measures the volume of flowing gases or steam or water. It makes accounting easier for both supplier and user, because it measures and records accurately. Its records can be used directly for billing.
- *In a large chemical plant,* it measures varying amounts of both water and alcohol in a flowing, mixed solution, and records the quantity of pure alcohol.

The Hagan Ring Balance Meter is so versatile that it can record up to four measurements simultaneously; measure specific gravity or density; automatically correct for temperature or pressure changes; integrate multiple flow data; and activate controls automatically.

This rugged yet sensitive instrument is typical of the advanced aids to industry which Hagan provides . . . in such varied fields as combustion and process control, force measurement, and industrial water conditioning.

Write for detailed information on Hagan Ring Balance Meters, included in our brochure of products and services. Ask for Bulletin GSP-901.

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News for the Consultant

Bridge Completed Four Months Ahead of Schedule

Palmer and Baker, Inc., Mobile, Ala., consulting engineers on the 23.8 mile Lake Pontchartrain Causeway, have credited simplified design and assembly line construction methods for completion of the project four months ahead of schedule. Bridge parts were prefabricated in a complete manufacturing yard constructed on the north shore of the lake by the contractors, Louisiana Bridge Co., a joint venture of Brown & Root and T. L. James & Co.

Components of the bridge were precast and prestressed in steel forms at the plant site, assembled, loaded on barges, and towed to construction points on the lake. Construction was accomplished in three phases: barge rigged units drove two 96-ft cylindrical concrete piles at the same time; another barge unit placed a steel reinforced cap on the two piles

4886 RAYMOND PRESTRESSED CONCRETE CYLINDER PILES SUPPORT 33-FOOT WIDE FLORIDA BRIDGE.

and sealed it with concrete; and the capped piles were topped with a 56-ft deck section which was then leveled to final road grade.

The 33-ft wide bridge is made up of 2246 spans with three raised humps to provide clearance for small craft and two double-leaf bascule bridges for passage of larger craft. The roadway is 28-ft wide, wide enough for three cars.

Because of its early opening, the bridge is expected to earn an unanticipated $600,000 by January.

The Causeway is the major artery of the Greater New Orleans Expressway, a $51 million network of highways connecting with major roads to Texas, points north, northeast, and west, and Gulf cities.

Design and construction supervision were by Palmer & Baker, Inc., Consulting Engineers, of Mobile, Ala. Freyssinet Company, Inc. designed the prestressing facilities for Louisiana Bridge, and Raymond Concrete Pile Company licensed the contractor to manufacture and install the piles.

New Developments in Fly Ash Utilization

Although it has been known for some time that utilization of fly ash in cement offers cost advantages to both utilities and cement producers, its use has been limited by a lack of specific information on the effect of carbon content on strength of concrete made with fly ash cement.

At the American Society for Testing Materials meeting in Atlantic City, officials of the U.S. Bureau of Public Roads presented papers on tests run to determine effect of fly ash in concrete. It was found that when fly ash replaced part of the cement in concrete, early strengths of the concrete were in each case lower than comparable concrete without fly ash, but in no instance did the fly ash concrete fail to exceed the flexural strength of conventional concrete at the one-year period. Other tests indicated that strength developed by portland cement-fly ash mortars is related to the carbon content of the fly ash, fineness of fly ash, and water required for mortars. Although fly ash of a selected quality, as measured by the strength index, generally met the limits for carbon content, loss of ignition, fineness, and water requirement ratio, it was pointed out that limits on these properties alone would not always insure a particular level of pozzolanic activity.

At the same meeting the Corps of Engineers reported on tests in progress on the kind and amount of fly ash as related to the potential reactivity of aggregates used in concrete.

At Allis-Chalmers' ACL pilot cement plant at the Carrollville Development Laboratory, commercially available gyratory screens, screening at 200 mesh, have been used successfully to remove 50 percent of the combustibles from fly ash. These results were obtained with tests on some 40 samples of fly ash from power generating stations throughout the

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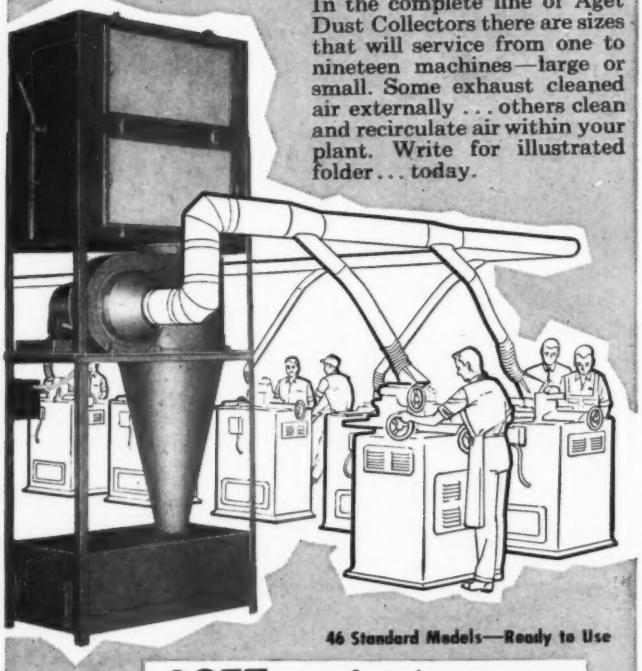
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country. This development promises a simple and economical way of reducing carbon content. The pilot plant also has been used to produce cement in which fly ash is substituted for shale or clay at low cost and with small dust loss.

Coal to Travel Through Pipeline From Mine to Power Plant

After five years of research on pipeline transportation of coal, Pittsburgh Consolidation Coal Company commissioned Ford, Bacon & Davis Inc. for the engineering design and supervision of construction of a ten-inch pipeline and pump stations to carry coal from the Hanna Coal Company strip mines, south of Cadiz, Ohio, to the Cleveland Electric Illuminating Company's Eastlake power plant, near Cleveland. The coal, pulverized and suspended in water, will be pumped through the 108-mile line

The Lincoln Electric Co.

CREWS AVERAGED BETTER THAN 2½ MILES A DAY.

at a rate of about 3½ mph. It is estimated that 1,300,000 tons of coal can be delivered per year.

Special welding materials and methods were necessary to weld the heavy wall sections of high tensile steel. Specification 5LX-42 pipe was used in five different pipe wall thicknesses. In cold weather, pipe was welded without preheating by not allowing it to cool between passes. The filler-pass welders, who moved in quickly behind stringer and hot-pass welders, kept two joints hot at the same time by alternating welding between two adjacent joints. In order to prevent underbead cracking, stringer-bead welders stripped three inches, top and bottom, before moving pipe to make the next line up. The crew consisted of 2 stringer welders, 3 hot-pass welders, and 12 on filler passes.

Wind Tunnel Designed To Test Modern Cars and Trucks

Ford Motor Company has broken ground at the new Research and Engineering Center, Dearborn Mich., for a wind tunnel to be used for determining effects of high speed driving on cars and trucks. Capable of developing air speeds up to 125 mph, the

TERRITORIAL HEADQUARTERS, THE SALVATION ARMY
ARCHITECT: *Skadberg-Olson Co., Chicago*
GENERAL CONTRACTOR: *Paschen Contractors, Inc.*

KAWNEER METAL WALL / *responsibility from the anchors on out!*

The new Salvation Army Territorial Headquarters in Chicago is another example of Kawneer's ability to engineer, produce and install a complete skin from the anchors on out. Kawneer works closely with the architect by helping him establish his design budget well in advance of the bids. Kawneer assures him that the translation of his design will be true and accurate. The curtain wall of this building will consist of Ingram Richardson 2" insulated porcelain enameled steel sandwich panels, double-glazed pivoted Kawneer aluminum windows and self-supporting aluminum mullions. Special weather-tightness features, adequate provision for expansion and contraction, and tested prefabrication methods assure the architect complete client satisfaction. For further information on how Kawneer can assist you in metal wall engineering write: Metal Wall Department, Kawneer, Niles, Michigan.

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Write for folders describing Kawneer metal wall jobs and windows.

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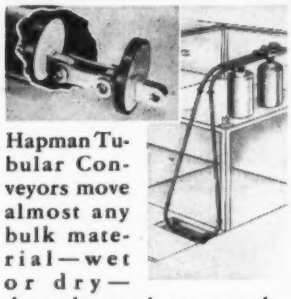
ARCHITECTURAL PRODUCTS DIVISION
1906–1956

HERE'S HELP

THAT SOLVES TROUBLESOME BULK HANDLING PROBLEMS:

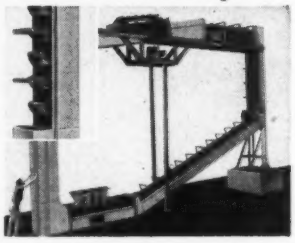
Hapman

Tubular and Pivoted Bucket Conveyors



Hapman Tubular Conveyors move almost any bulk material—wet or dry—through any plane or angle. They're dust, liquid and odor-tight. Investigate!

Write for Bulletin T-CE106.



Exclusive top loading device on Pivoted Bucket Carrier handles fragile materials gently. Many other unique advantages.

WRITE for Bulletin P-CE106

Hapman CONVEYORS, INC.

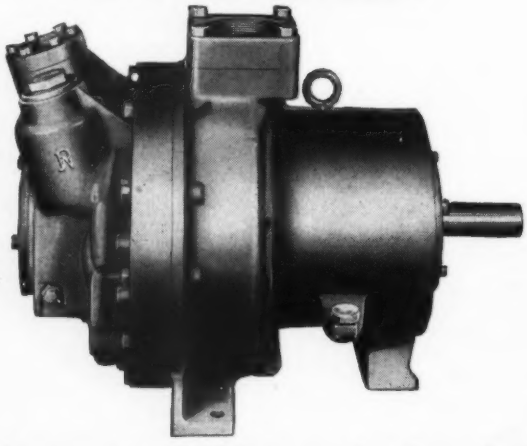
DIVISION HAPMAN-DUTTON COMPANY

KALAMAZOO MICHIGAN

In British Commonwealth & Europe: Fisher and Ludlow Ltd., Birmingham

PYLE-NATIONAL

TURBINES



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For the mechanical drive of pumps, exhaust fans, blowers, stokers, abrasive wheels, agitators, generators and other machinery. Operate with steam, gas or air.

Write for Bulletins No. 4110-A to 4110-F inc., describing this outstanding line of small and medium capacity turbines ranging from ¼ to 120 horsepower. Also Bulletin on turbo-generators rates 500 to 15,000 watts, D.C.

THE PYLE-NATIONAL COMPANY

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SINCE 1897

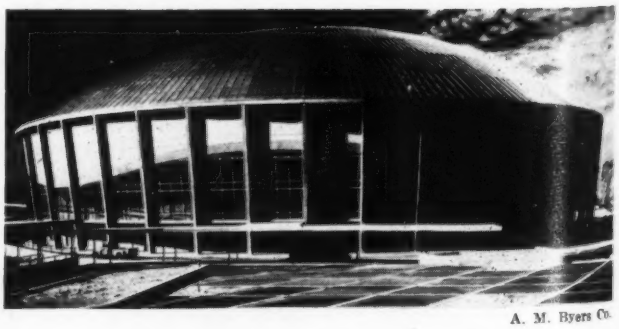
tunnel will be large enough to test full-scale models. A single 20-ft fan, driven by a 2500-hp motor, will generate the desired air speeds, and a 2000-ton refrigeration system will cool the air to any temperature down to 0 F. To simulate desert driving conditions, the heating plant will provide temperatures up to 150 F. From such test results, the engineering department will be able to develop more efficient aerodynamic shapes, better seals, and quieter interiors.

Designed and engineered by Burns and Roe of Michigan, Inc., the tunnel will be built of reinforced concrete and lined with a prefabricated sandwich of aluminum-faced cellular insulation. All seams will be vapor-proofed to permit close regulation of humidity. Completion is scheduled for next summer.

Engineer-Architect Amendment Meets Opposition in California

The proposed state constitutional amendment being submitted to California voters at the November election to enable the state to employ private engineers and architects on a contractual basis on state projects is strongly opposed by the California State Employees Association on the grounds that it menaces the entire civil service structure. The official voters' pamphlet, assembled by the secretary of state, contains an opposition statement by Senator Alan Short, San Joaquin County, that there is no need or justification for the amendment and that it will increase the cost of government without increasing efficiency of state engineering service.

The amendment was drawn up by a Senate Interim Committee on Public Works appointed by the 1955 legislature to make studies of the Department



A. M. Byers Co.

DESIGNED FOR 125 MPH WINDS.

Dome of the $5 million Civic Center at Charlotte, N. C., 335 ft in diameter, and supported by 48 reinforced concrete columns around the periphery, was designed to withstand winds up to 125 mph. Building includes a 202 x 85 ft ice skating rink. Mechanical engineering was done by W. P. Wells; architect was A. G. Odell, Jr. and Associates, both of Charlotte.

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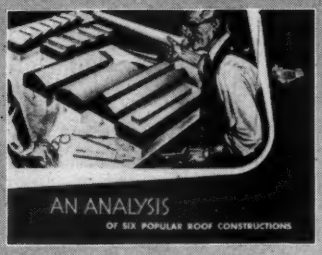

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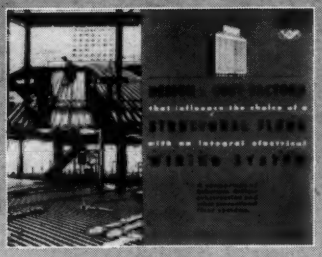

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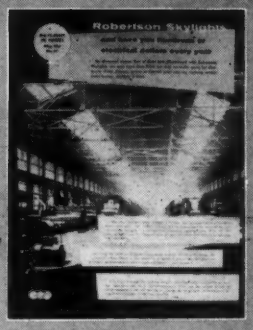

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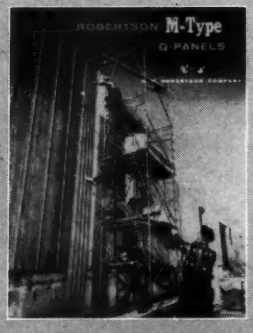

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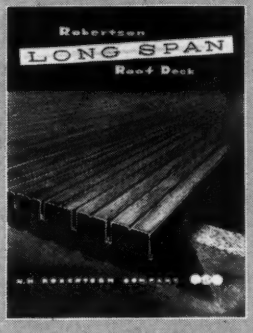

8

Write- for these free books from Robertson's technical library

1. Acoustical Data on Q-Deck: It has long been known that the fluted underside of steel deck provides some acoustical value, yet demand for more has led to this new low-cost method. Application details and test data are included.

2. An Analysis of Industrial Roof Construction: This valuable booklet compares all the better-known roof types (flat, monitor, bow-string, high-low bay, saw tooth) on the basis of structural steel, volume, roofing, sash area, flashing, ventilation and daylighting.

3. Design and Cost Factors of Structural Floor Wiring: This study compares Q-Floor with other conventional floor systems using underfloor duct. Based upon a typical multi-story building, the book is replete with charts and cost analyses of all structural components.

4. Daylighting Cost Analysis: This new and unusual study contains a questionnaire, which when properly filled out will reveal how quickly scientifically planned natural daylighting will pay for itself in a structure through savings in electricity. All data are substantiated.

5. New Composite Q-Floor Catalog: This newly revised catalog contains many examples of the latest Q-Floor buildings and a full exposition of Q-Floor advantages. Structural details and specifications are more complete than ever before.

6. New M-Type Q-Panel Catalog: Recent newcomer to the Robertson product family is the M-Type Q-Panel which possesses unique advantages over other types of modern curtain wall construction. The book contains 3 pages of structural details plus complete specifications.

7. New Long-Span Q-Deck Catalog: Another new Robertson product is this sturdy, yet exceptionally long-span deck. Easy to handle and erect despite its length up to 32 feet, it is especially designed for schools and supermarkets and other structures in which unbroken spans and a saving of structural steel is beneficial.

8. Ventilation Engineering Booklet: More than a ventilator catalog, this booklet not only describes products, but contains detailed tables of exhaust capacities, based upon average wind velocities, temperature differences and height above intake. Use the coupon below.

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Please send the free data book(s) I have circled below.

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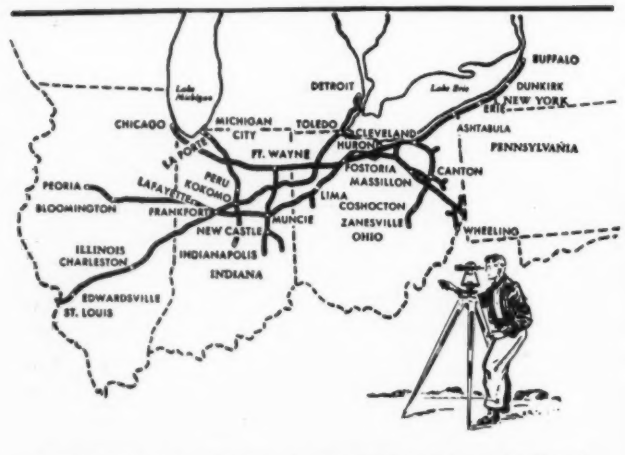

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of Public Works, particularly of the Division of Architecture and its activities.

Engineers and architects in California formed a Joint Steering Committee this spring to work for passage of the amendment.

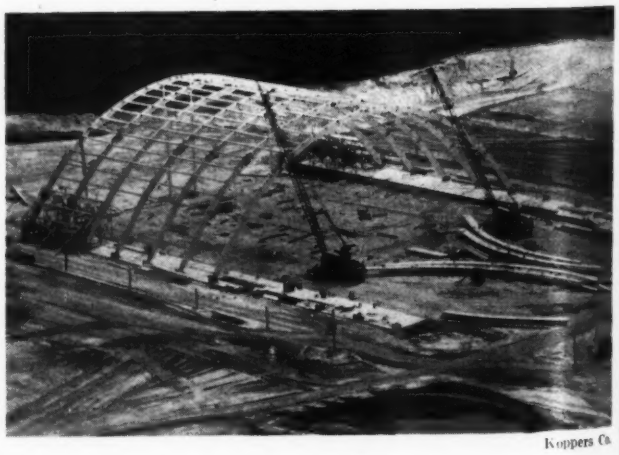
Senator Short claims that the ruling would be confusing and difficult to administer and that it substitutes political pressure for the merit system in doing state work.

Senator John F. McCarthy, author of the amendment, contends that it is necessary to clarify the existing civil service law and to provide for prompt and economical completion of state public works. California is the only state whose constitution forbids use of consultants and architects on state jobs.

Cities Prepare For Increased Urban Traffic

A comprehensive parking study covering the 96 blocks in downtown Wilmington, Dela. has been started by Wilbur Smith and Associates, of New Haven, Conn. The survey was ordered by the Wilmington Parking Authority to produce a detailed 10-year guide for the development of parking garages, lots, or other facilities in areas recommended by the study.

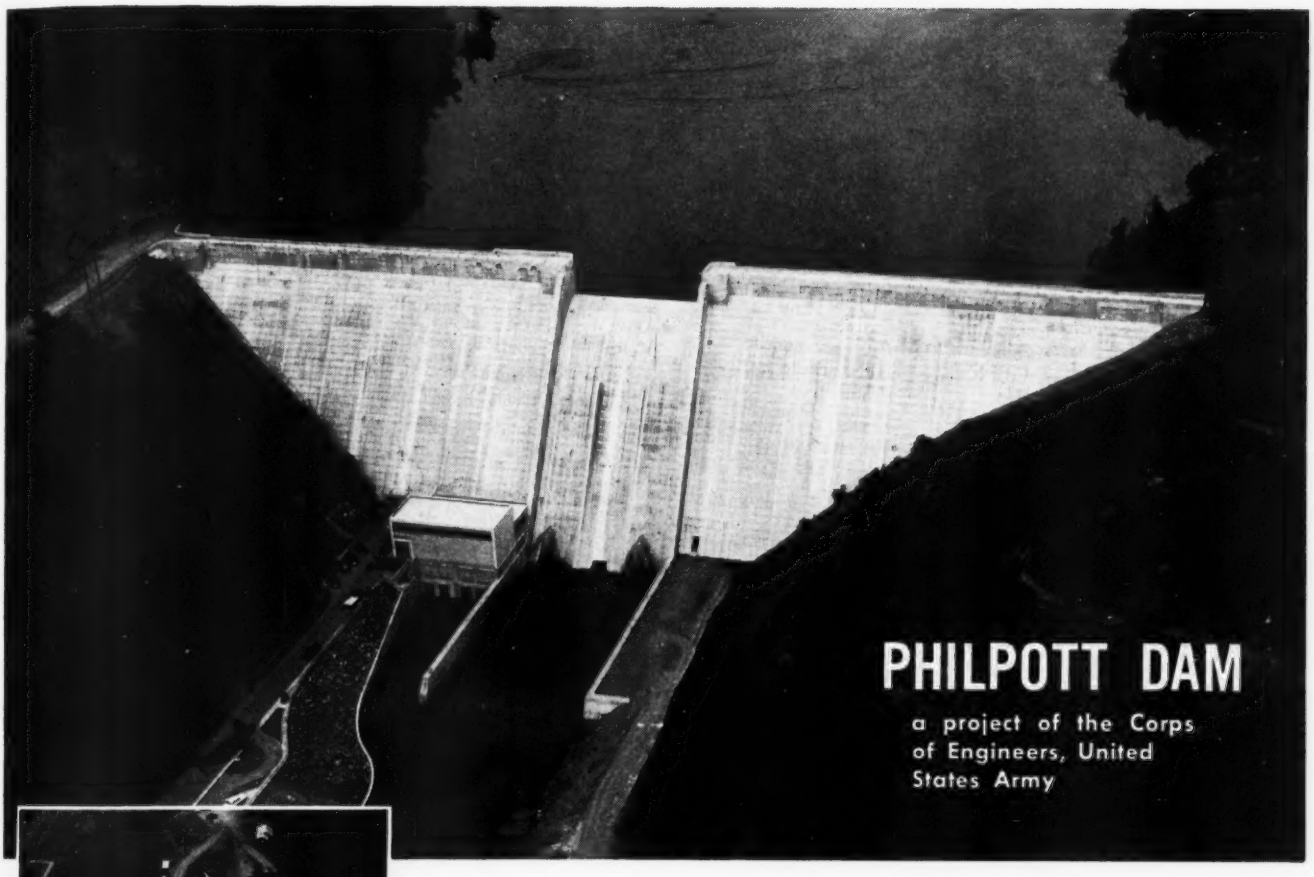
The Columbus, Ohio, State Underground Parking Commission has accepted a preliminary report submitted by Wilbur Smith and Associates recommending a 1000 to 1100-car capacity garage be constructed under the Statehouse grounds in Columbus.

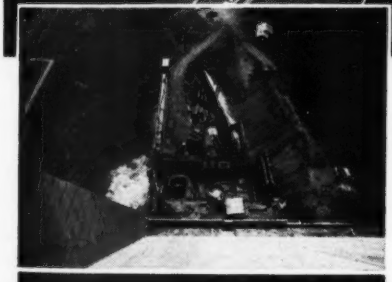


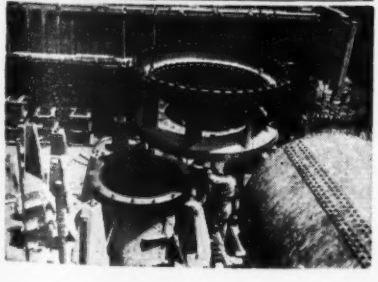
Koppers Co.

ROOF WITHOUT A NAIL.

Aerial view shows early stage in construction of the Long Island Sports Arena at Commack, N. Y. Twelve arches, each made of 28 laminations of 2-in. pressure bonded lumber, support the roof. Ten interior arches are 9 in. wide, and 36 to 46 in. in depth at point of maximum stress. Two smaller arches at ends of arena are 5 in. wide. All arches extend over a clear span of 206 ft. Structural engineer for foundations and buttresses was David Naiman Associates, and architect was James Van Alst. Structural design of the arches was by Unit Structures Inc.







Another Outstanding Installation of **Leffel Hydraulic Turbines**

Philpott Dam, a recent Corps of Engineers, United States Army, project on the Smith River in Henry and Franklin Counties, Virginia, is a site of another outstanding installation of efficient dependable Leffel turbines. The Philpott project was constructed for flood control and hydroelectric power generation. It is one unit of a comprehensive reservoir system planned for the Roanoke River basin.

Three Leffel turbines were installed at the Philpott power plant. Two are each rated at 9400 hp under 152 ft. net head, at a speed of 227 rpm; and the third is rated 860 hp at 720 rpm.

The view above shows the completed project. The views at the left show the project under construction, the spiral casing for one turbine in place, and a stay ring being lowered into place over the draft tube.

Other Leffel installations are dependably and efficiently producing power from water in this country and in all parts of the world. Leffel engineers are waiting to put their 94 years of experience with water power to work for you, whether your project is a completely new installation, or an expansion or rehabilitation of existing facilities. Write today for literature describing Leffel turbines for all hydraulic power requirements and showing a wide variety of outstanding Leffel installations.

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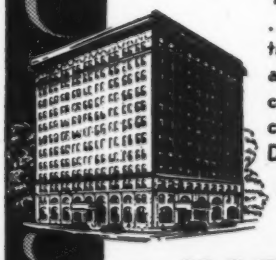

Ideally located in St. Louis, two short blocks from the Union Station and in the center of the Wholesale District . . . Preferred, always by experienced travelers because of its outstanding advantages— Every room with combination tub and shower . . . and circulating ice water.
Delicious food . . . cheerful service.
AIR-CONDITIONED ROOMS
350 rooms from $3.50
HOTEL LARIDGE
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Free Parking
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The report estimated that annual gross income would approximate $416,931 during the first year of operation, with an average annual income of $511,957. Smith has been asked to submit sketches and a cost analysis showing expense of proposed pedestrian tunnels, and to study the possibility of substituting escalators for elevators.

Although the validity of state enabling legislation for a bond issue to finance an underground parking garage beneath the Omaha, Nebr., Douglas County Courthouse is still before the courts, the Parking Authority is considering proposals submitted by engineering, architectural, and construction firms.

Leo A. Daly Co., consulting engineers; Kirkpatrick-Pettis Co.; and Peter Kiewit Sons Co., consulting engineers, submitted a joint proposal to make a feasibility study, handle the bonds, and supervise construction. They would use Wilbur Smith and Associates for traffic surveys.

Ralph H. Burke, Inc., engineers on the Chicago underground parking facility, have proposed to do an economic feasibility study and engineering of the project. B. H. Backlund and Associates, Inc. submitted a proposal in which they specified that they would use the Smith firm for traffic studies.

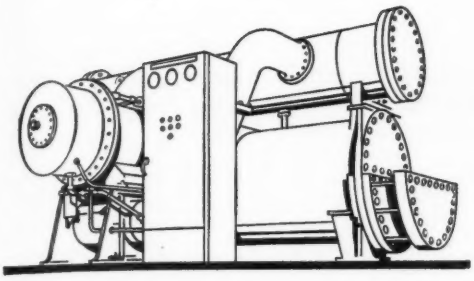
Henningson, Durham and Richardson and Kirkham-Michael and Associates, consulting engineers, entered a joint proposal. Other individual proposals were from Walter Butler Co. and The H. K. Ferguson Co., engineers and constructors.

Cathodic Protection Pays Its Way For Marine Structures

One of the most important factors in figuring ultimate cost of piers and pier foundations is the rate of deterioration due to corrosion. Sea water environments in contaminated estuaries often upset normal calculations of the rate of corrosion penetration, according to David Hendrickson, Senior Engineer of The Hinchman Corp., Consulting Corrosion Engineers. Small, clean steel specimens will corrode in normal sea water at a rate of approximately 0.005 in. per year from each exposed surface. Long steel structures such as piles will corrode at two to four times this rate.

Accelerated corrosion on steel piling often results from the differential environment created by greater concentration of oxygen near the surface of the water, making the upper portion of the steel piling cathodic to the lower portion. Variation in concentration of contaminants at various levels of the water also will cause accelerated corrosion. Sewage and industrial waste may be responsible for severe corrosion in estuaries.

In an investigation made by The Hinchman Corp. on a wharf less than seven years after its construction, the steel had corroded away to such an extent that the extra steel specified to allow for corrosion deterioration was substantially gone, and the load design stresses were being approached. The results of the tests indicated that, although the pier had been built for a 50-year life span, its useful life would be only about 15 years.



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Tonrac* requires no built-up bases!

An advanced-design, single-stage hermetic centrifugal refrigerating machine – Tonrac comes *complete* – ready for installation on *one* level.

Needs no built-up bases, flexible couplings or speed-increasing gears: single impeller is directly driven by constant-speed 3600 rpm motor. Saves space, weight, installation costs!

Let American Blower meet all your air conditioning needs! A complete product line – from Packaged Air Conditioners to Multi-Zone Units, Central Station Air Conditioners and Fans–means that you get *undivided responsibility* right down the line. Contact our nearest representative, or write us direct today. American Blower Corporation, Detroit 32, Michigan. In Canada: Canadian Sirocco Company, Ltd., Windsor, Ontario.

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1 Condenser – Counterflow circuit; effective gas distribution; liberal surface area.

2 Single-Stage Compressor – Variable inlet guide vanes, single-stage aerodynamic impeller. Special design of volute casing improves diffusion.

3 Marine-Type Water Boxes permit cleaning or replacement of tubes without disturbing water connections.

4 Evaporator – Semi-flooded operation and uniform distribution provide efficient, sustained heat transfer. Eliminators assure dry gas.

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8 Motor – Hermetically sealed; water-cooled; constant speed. Sleeve and Kingsbury thrust bearings.

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Air conditioning equipment for every business

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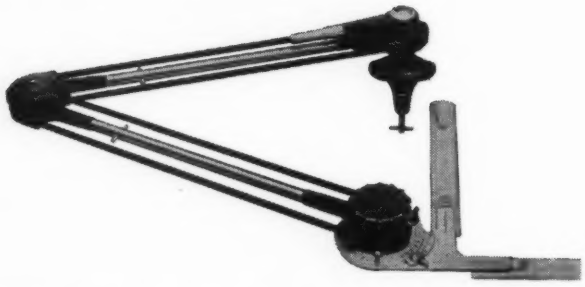

In the VEMCO Drafting Machine, the working features of a T-square, a protractor, various scales and triangles are combined into a single unit, ready for immediate use and leaving the drawing surface clear for convenient working. Its careful design, precise construction, and ease of operation meet the most demanding professional requirements.

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This structure is over 1000 ft long by 150 ft wide with a concrete deck supported by more than 2000 steel bearing H piles. The piles have an average penetration of 55 ft into the ground and an average water immersion of 45 ft at high tide.

The economics involved in using cathodic protection on this $4,000,000 structure are given in the table. Data on steel piling capped with concrete and in sea water is from Fred P. Terry, Corrosion Engineer, East Bay Municipal Utility District, Oakland, California.

Factors	Without Protection	With Cathodic Protection	
		Steel Piling	Steel Piling Capped With Concrete
Years of life	15	50	50
Cost installed	$4,000,000	$4,096,000	$4,134,400
Annual depreciation	$ 266,666	$ 81,920	$ 82,688
Annual operating cost of protecting	——	$ 6,296	$ 8,814
Total annual cost	$ 266,666	$ 88,216	$ 91,502
Annual saving from corrosion control	——	$ 178,450	$ 175,164
Total saving for 50 years	——	$8,922,500	$8,758,200

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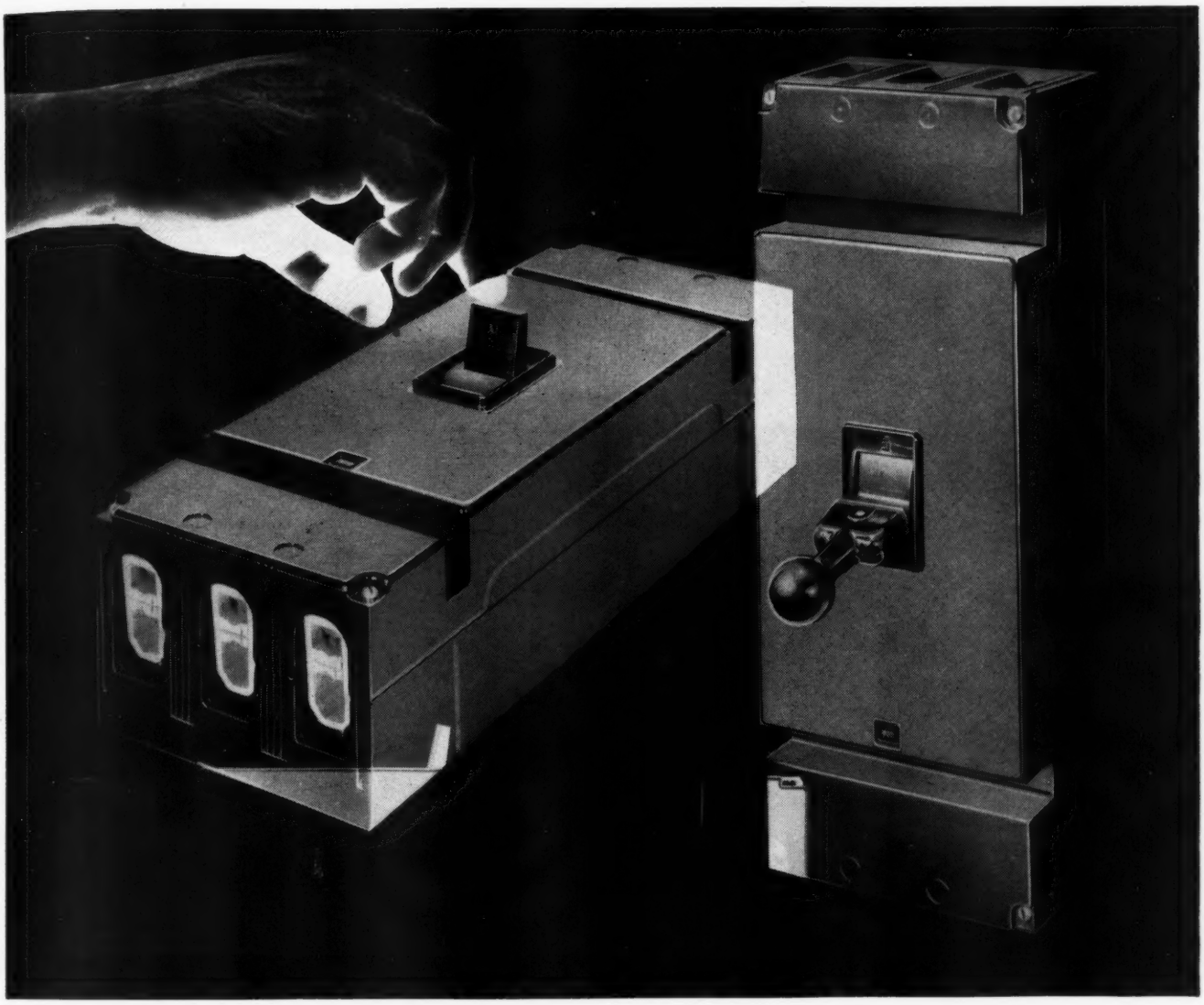


The Westinghouse Type M—only fully rated 800-ampere, molded-case circuit breaker . . .

Saves 3/4 cost of larger devices

Over a year of customer use, as an alternative to larger 800-ampere protective devices, has proved the economical advantage of the Westinghouse Type M AB De-ion® circuit breaker.

Whether you use it singly enclosed or in a switchboard, you'll find it can save ¾ the cost of a larger air circuit breaker. Space or mounting economies may run the savings even higher—such as the use of this design in building compact distribution panelboards.

Though the smallest device of its rating, the new model will carry its full current rating in normal ambients even when enclosed—something other thermal devices cannot do. This feature of ambient compensation is useful in applications where standard units might unduly penalize system capacities. Both the Westinghouse *true 800-ampere* alternate and the standard thermal magnetic trip types are U.L. listed.

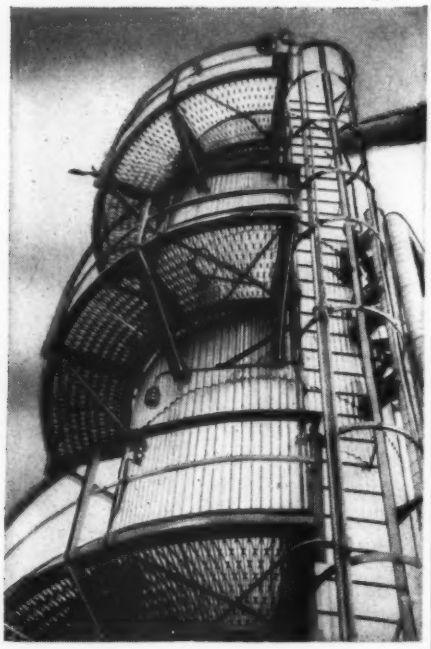
You owe it to yourself to get all the facts on the Westinghouse Type M circuit breaker. Get 'em today from your local Westinghouse sales office—or write direct to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

J-30214

WATCH WESTINGHOUSE!

*WHERE **BIG** THINGS ARE HAPPENING FOR **YOU***

RAIN OR SNOW CAN MAKE CATWALKS DANGEROUS



Walkways, catwalks and treads made of solid wood, metal or other material can collect snow, rainfall, grease or oil and become dangerously slippery.

But these walking surfaces, made of an open mesh of metal bars on edge, cannot collect these substances, leaving the surface always clean, dry and tractional for safer access to high places.

As founders of the grating industry, the Irving Company can draw upon over half a century of experience to supply you with quality grating products for catwalks, treads and other practical and economical uses.

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Write for our General Grating Catalog.

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MEN IN ENGINEERING

Parsons, Brinckerhoff, Hall & Macdonald announce retirement of Eugene L. Macdonald and Lawrence S. Waterbury as general partners. They will serve as consultants to the partnership and Macdonald continues as Chairman of the Board. Waterbury has opened his own consulting office at 26 Broadway, New York City.

Flynn E. Hudson, Jr. and L. Miles Sheffer have announced the opening of the office of Hudson-Sheffer and Associates at 145 Carter Road, Decatur, Ga.

J. A. JOHANNESSEN

J. A. Johannessen, partner of Johannessen and Girand, Consulting Engineers, of Phoenix and Tucson, Ariz., has been elected president of the Phoenix area chapter of Arizona Consulting Engineers Association. He is a member of AIEE and NSPE.

Jens Koch, landscape architect, has joined Rader and Associates, engineering and architectural firm with headquarters in Miami, Fla.

Appointment of Deane O. Hubbard as a specialist in chlorine plant design has been announced by The H. K. Ferguson Co. He will coordinate and supervise design and construction of chlorine and related projects.

The Philadelphia engineering firm of Salvatore S. Guzzardi is expanding its services to modernization and design of plant service utilites. J. James Mirabile is now associated with the firm as industrial engineering consultant.

Joseph W. Moorman has been appointed midcontinent district manager for James P. O'Donnell, consulting engineer. Mr. Moorman's headquarters will be at Tulsa, Okla.

A. P. Schnyder has joined The Lummus Co. as consulting engineer for the Pulp and Paper Mill Div. An electrical engineering graduate of Federal Polytechnic in Zurich, Switzerland, Schnyder contributed the Pulp and Paper Mill Section of the Standard Handbook for Electrical Engineers.

Harry M. Betzig has joined the Chicago engineering firm of Pollak & Skan, Inc., as chief engineer of their newly formed process engineering division. He was formerly principal engineer for Blaw-Knox Co., Chemical Plants Div., Chicago.

I. L. Harper, mechanical engineer, and William G. Macdonald, electrical engineer, are now associate members of the firm of Ericksen, Ellison and Associates, Inc., St. Paul, Minn.

E. V. Miller, formerly Idaho State Highway Engineer, has joined the firm of Johannessen and Girand Consulting Engineers, of Phoenix and Tucson, Ariz., as engineer in charge of the highway division.

The New Jersey Society of Professional Engineers has awarded its 1956 Engineering Award to Morris Goodkind, of Goodkind & O'Dea, for outstanding achievements in bridge design. He was formerly director and chief bridge engineer of the New Jersey State Highway Department.

The Ballinger Company, Architects & Engineers, have moved into their new offices at 1625 Race St., Philadelphia. Air-conditioned, the office building is the first in the

THE MARK OF QUALITY

BARBER COLMAN

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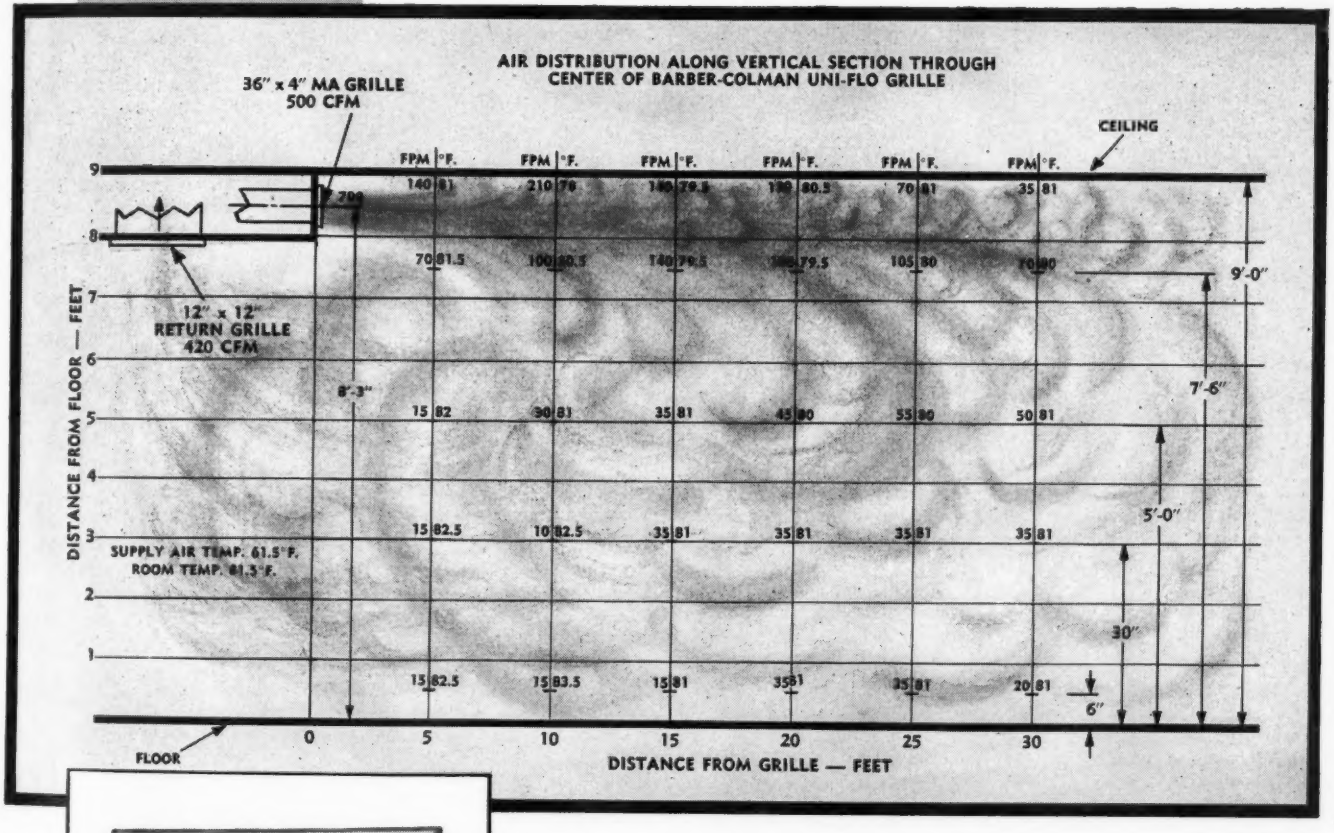
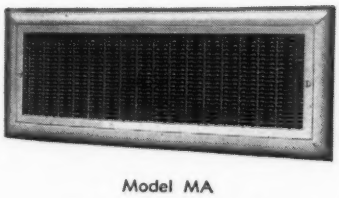
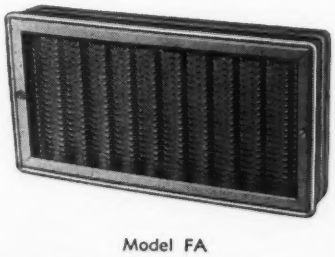
Engineered Air Distribution

predict and deliver air patterns like this...





Model MA
Double-Deflection Grille



Model FA
Double-Deflection Grille

Precision distribution of conditioned air from sidewall grilles is no problem when you specify Uni-Flo. Uni-Flo Grilles are true sidewall diffusers, designed to give adjustable air pattern and rapid diffusion without air stream drop or excessive air motion. Laboratory-tested, field-proved performance data permit the engineer to create required conditions without guessing. Variety of types available. For complete details, call your nearby Barber-Colman Field Office, or write . . .

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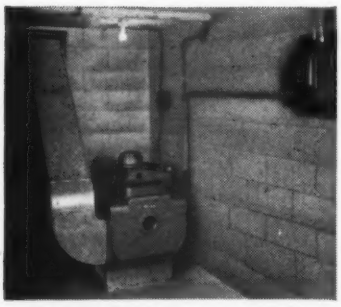
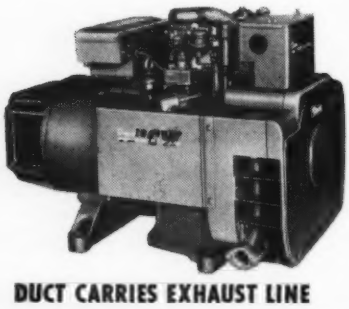
Field Offices in principal cities

HOW Vacu-Flo AIR-COOLING SIMPLIFIES INSTALLATIONS OF ONAN ELECTRIC PLANTS



VENTILATES INSTALLATION AREA

Vacu-Flo cooling takes air from the room, through the electric plant, and expels it outside through a single duct. Eliminates fumes; keeps room filled with fresh air.



DUCT CARRIES EXHAUST LINE

On the Onan CW series of electric plants (7½ and 10KW), the exhaust pipe is carried through vent duct to the outside making only a single opening necessary.

Heated air expelled outside through single vent. Units can be enclosed or "buried"

Air-cooled Onan Electric Plants can now be installed in small, enclosed compartments; in isolated or underground rooms; or "buried" within a vehicle, far from the outside air. Previously impossible or difficult installations are now easy and practical with Onan Vacu-Flo cooling.

This exclusive system is a factory-equipped item, optional on any Onan air-cooled electric plant. A quiet-running, centrifugal blower in a specially-designed housing PULLS cooling air through the generator and over the engine . . . then EXPELS heated air through a duct to the outside.

The space required in a "buried" installation need be only a little larger than what the unit itself requires. Air-intake and vent openings plus an exhaust line are all that are necessary.

On vehicles such as trailers, display vans, fire and rescue trucks, and concession wagons, Vacu-Flo cooling makes it possible to mount the Onan plant anywhere in the body where space is available. On pleasure and work boats, Vacu-Flo cooling makes below-deck installations of air-cooled electric plants practical . . . cooling efficiently and quickly eliminating fumes from the area.

Onan Electric Plants with Vacu-Flo cooling operate more quietly than blower-cooled models . . . an important added advantage in many installations.

Write for Special Vacu-Flo folder.

D. W. ONAN & SONS INC.

Onan ELECTRIC PLANTS

2852 University Avenue Southeast, Minneapolis 14, Minnesota

Philadelphia area to utilize the air-source heat pump.

Earl V. Akerlow has been appointed an assistant division manager in the Engineering Dept. of Kaiser Engineers. In his new position, he will be responsible for the coordination of engineering on the current $113 million expansion program at Kaiser Steel's Fontana, California plant.

Jack E. Leisch, formerly chief of design development section of the U. S. Bureau of Public Roads, has joined De Leuw, Cather & Co.

The office of A. Carl Stelling, site planning consultants, has announced reorganization of the firm into a partnership to be known as A. Carl Stelling Associates. Partners, besides Stelling, are: Dante J. Caldera, professional engineer; Everett Lord-Wood, town planner; and William Rutherford, landscape architect. Edward Forrest, civil engineer, has been named an associate.

The partnership of Browning and Landstreet, Consulting Engineers, Raleigh, N. C., has been dissolved. The new name of the firm is Robert C. Browning, Consulting Engineer. Landstreet will practice engineering from his home in Fort Payne, Ala.

Francis G. Dunnebacke has joined J. M. Little & Associates, industrial designers and engineers, as assistant to Hugh K. Hybarger, director of engineering of the Engineering Div.

DUNNEBACKE

RAVNEBERG

Joining the firm of Lockwood, Kessler & Bartlett, of New York, is Noel M. Ravneberg, engineering geologist. He was formerly with the New York State Department of Public Works, specializing in field seismic surveys.

Eberle M. Smith, of Eberle M. Smith Associates, Inc., has been awarded the "Man of the Year" Award by the Portland Cement Association for his work on the Ford Motor Co. Rouge Office Building, River Rouge, Mich.; the Edsel Ford Senior High School, Dearborn, Mich.; and the Derby Junior High School, Birmingham, Mich. The Ford office building is one of the largest buildings ever designed for lift slab construction. ▲▲

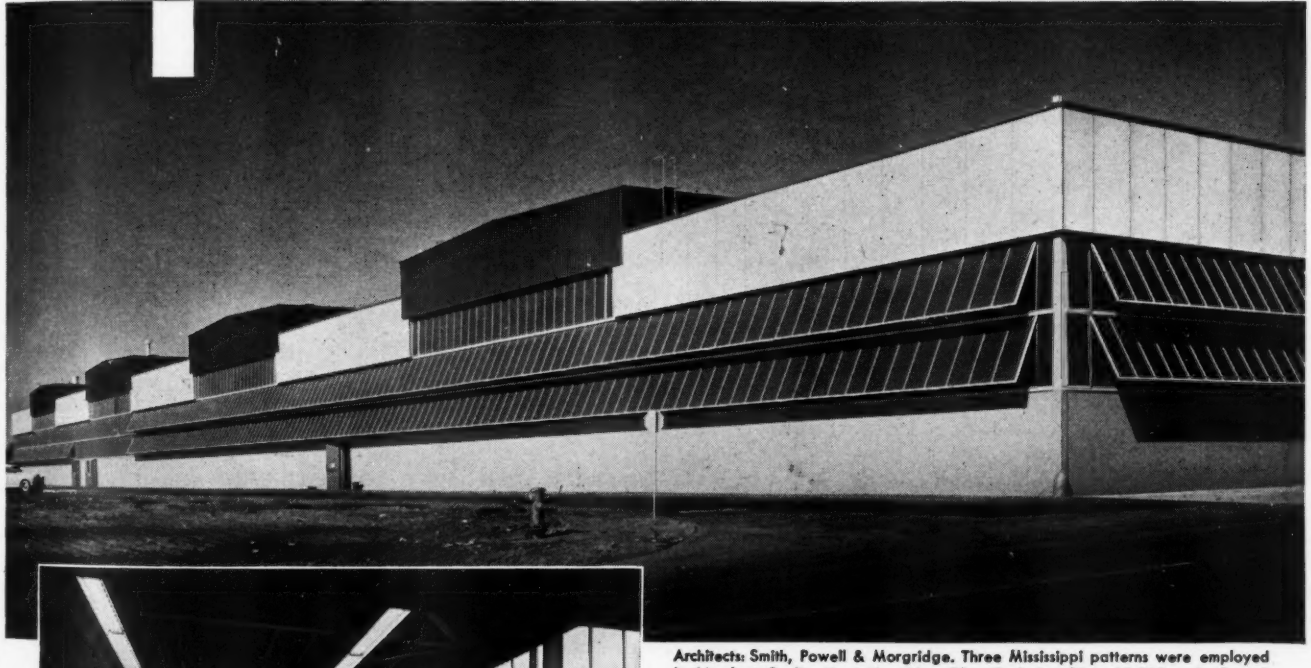
LIGHT and AIR without HEAT and GLARE

Coolite Installed in Top Hinged Windows Floods Factory with Conditioned Daylight

Excellent ventilation and plentiful, eye-easy, natural illumination promote employee efficiency and morale in this United States Electric Motor Plant, Anaheim, California. The hinged windows are glazed with Coolite, Heat Absorbing, Glare Reducing Glass to provide the finest, low-cost daylighting.

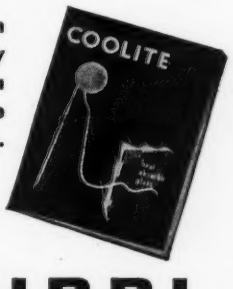
Coolite diffuses better light deep into interiors, eliminates contrasts that cause costly visual errors. Coolite absorbs up to 50% of unwanted solar heat rays, helps keep work areas cooler. Employees see better, feel better, work better, under "Cooliting."

This outstanding plant also uses diffusing Wire Glass for excellent daylighting plus protection against breakage and fire in vulnerable areas. Installed in doors, windows, skylights, Mississippi Wire Glass (Approved Fire Retardant No. 32) helps to bottle up small fires . . . keep them from roaring into costly conflagrations.



Architects: Smith, Powell & Morgridge. Three Mississippi patterns were employed in this plant: Coolite, Heat Absorbing, Glare Reducing Glass, 19,212 sq. ft.; Smooth Rough, 5,256 square feet; Coolite Wire, Glare Reduced, 5,377 sq. ft.

Let Coolite brighten your production picture with better daylighting. Specify glass by Mississippi. Available in a wide range of patterns and surface finishes through leading distributors.



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New Projects Reported

By Consulting Engineers—

ALABAMA

Marshall E. Parker, Survey of existing cathodic protection system, natural gas transmission system. Client, Alabama-Tennessee Natural Gas Co.

ARKANSAS

H. Price Roark, Structural Eng., Edgar K. Riddick, Jr., Mechanical Eng., Erhart, Eichenbaum & Rauch, Architects. Dormitories and recreation facilities for University of Arkansas Medical Center, Little Rock. $2,000,000. Client, University of Arkansas.

CALIFORNIA

The Fluor Corporation, Ltd. Design, engineering, and construction of a 66/16 kv substation. $425,000. Client, Southern California Edison Co.

Leroy F. Greene. Fresno County General Hospital, Fresno, Calif. Basement plus six stories; concrete pan joist construction. Concrete frames resist longitudinal earthquake forces, shear walls resist transverse forces. $4,500,000. Client, Horn and Mortland, Associate Architects.

John S. Bates and Roy M. Trotter. Preliminary studies and plans for a sewage collection and disposal system. Study of existing sewer collection and disposal systems and preparation of master plans for these systems. Client, Crescenty City, Calif.

COLORADO

Ramsey & Reeves, Consulting Engineers & Architects. Office building and parking garage, Denver, Colo., 60,000 sq ft, flat plate concrete construction, porcelainized metal skin walls, completely air conditioned. $700,000. Client, owner, Arapahoe Building Co., lessee, Allstate Insurance Co.

Alfred J. Ryan & Associates. Tunnel rehabilitation, Busk-Ivanhoe Tunnel, Lake County, Colo. $400,000. Client, Highline Canal Co., Rocky Ford, Colo.

Canal improvements, Vasquez-St. Louis collection conduit, Grand County, Colo. $750,000. Client, Denver Municipal Water Works.

Permanent facilities, FY 1957, Fort Carson, Colo. $5,000,000. Client, United States Army.

CONNECTICUT

R. S. Loomis, Consulting Engineer, Wilson First National Store, Windsor, Conn. $180,000. Client, Kane & Fairchild, Architects.

Fox-Press printing plant, Hartford, Conn. $70,000. Client, Rossetti & DiCorcia, Architects.

Beth El A.M.E. Church addition, Hartford, Conn. $20,000. Client, Rabbi Shields.

Arrow Lines, garage and warehouse, East Hartford, Conn. $150,000. Client, Berenson & West, Architects.

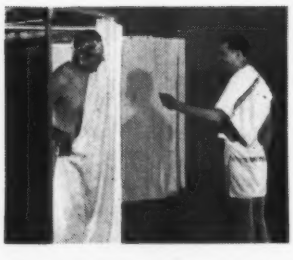
Fred S. Dubin Associates. Repairs and new heating system. Wilson Street School, Hartford, Conn. $40,000. Client, City of Hartford.

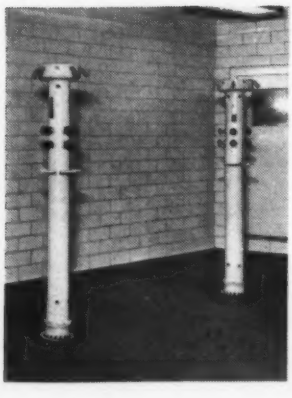
First Presbyterian Church, plumbing, heating, ventilating, electrical. $680,000. Client, architect, Harrison & Abramovitz.

Sacred Heart Parochial School, Taftville, Conn. Forced warm air heating, plumbing, electrical, and utilities, $200,000. Client, Arthur Thomas, Architect.

Salem School addition, Salem, Conn. Plumbing, heating, and electrical. $100,000. Client, Arthur Thomas, Arch.

Bradley Multi-Stall Shower Units installed in new E C & M Cleveland plant by Spohn Heating and Ventilating Co.—*Architects and Engineers,* Arthur E. Rowe & Associates; Sam W. Emerson Co., *builders.*





MODERN MULTI-STALL SHOWERS MEET MODERN PLANT REQUIREMENTS

Typical of the fine equipment in the new E C & M's plant are the Bradley Multi-Stall Showers. Each unit has three stalls requiring but one set of piping connections—hot and cold water, and drain.

Aside from savings in space and piping connections, many users consider the central mixing chamber a big feature because it protects against discomfort or possible burns that result from sudden unexpected changes in water temperature when an adjacent shower is turned on or off.

Bradley Column Showers are also available without partitions and curtains as shown at left. Bradley Column Showers provide excellent facilities in minimum space at the lowest possible cost. Complete specifications are included in new Catalog 5601 . . . BRADLEY WASHFOUNTAIN CO., 2339 W. Michigan St., Milwaukee 1, Wis.

Cat. 5601. Copy mailed on request.

BRADLEY multi-stall showers

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Big savings . . .

can be made in the original installation cost by transmitting electric power and lighting current at higher voltages to load centers, then stepping it down to the utilization voltage with Sorgel dry-type transformers.

SORGEL transformers are so compact that they do not require much space, and can be installed in most any convenient or out-of-the-way place inside of buildings. They do not require fire-proof vaults nor enclosures.

SORGEL dry-type transformers are so quiet in operation that they are particularly adaptable for indoor installations — in hospitals, libraries, schools, institutions, office buildings, stores, and other structures where low sound levels are an important factor.

INCREASED EFFICIENCY — Installation close to the load centers results in shorter feeders, better voltage regulation, more efficient distribution, and lower wiring cost.

SAFE, LOW OPERATING TEMPERATURE.

LIBERAL DESIGN—Can safely carry an overload during an emergency.

EASY INSTALLATION — Attached mounting brackets.

EASY CONNECTING — Roomy connection compartment with solderless terminals.

LONG LIFE — Thermo-vacuum impregnated windings brazed to terminals.

UNDERWRITERS' APPROVED — SORGEL dry-type transformers are Underwriters' approved in all ratings covered by the Underwriters' Re-examination Service, both single phase and 3-phase.

A Perfect Partner for Substations

SORGEL transformers, either dry-type or Askarel-cooled, can also be incorporated in substations, complete with primary and secondary switchgear. They are procurable with any make of switchgear, and from any substation manufacturer.

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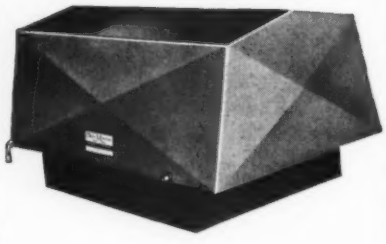

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C. L. AMMERMAN CO.
110 North Second St.
Minneapolis 1, Minnesota

Muzzillo and Tizian. University of Connecticut, Storrs. Addition to Commons Bldg., Central Commissary Bldg. $1,200,000. Client, architects, Urbahn, Brayton, and Burrows.

DISTRICT OF COLUMBIA

Herbert Manuccia, P. E. & Associates. Officers Nurses' Quarters, Andrews Air Force Base, Washington, D.C. $200,000. Client, U. S. Air Corps and B. L. Frishman Associates, Architects.

Operations Training Building, Andrews Air Force Base, Washington, D.C. $140,000. Client, U. S. Air Corps and B. L. Frishman Associates, Architects.

FLORIDA

Russell & Axon. Sewage collection system and sewage treatment plant. Pinellas County, Fla. $2,100,000. Client, Long Key Sewer District Board.

Water works improvements and sewage collection system and sewage treatment plant. $340,000. Client, Town of Belleview, Fla.

ILLINOIS

Farkas and Barron. Illinois Turnpike, Section T-3, 5.2 miles, Illinois State Toll Highway. $5,300,000.

Beling Engineering Consultants. Frohardt School, Granite City, Ill. Client, Joseph D. Standish.

Marshall School, Granite City, Ill. Client, Joseph D. Standish.

Star-Courier Newspaper Bldg., Kewanee. Client, Lankton-Ziegele-Terry.

Joyce 7-Up Bottling Works, Champaign, Ill. Client, Kruegel, Wilkins.

Winnebago High School, Winnebago, Ill. Client, Raymond A. Orput.

IOWA

Beling Engineering Consultants. SUI Married Students Housing, Iowa City, Iowa. Client, Morgan & Associates.

Marshalltown Lutheran Church, Marshalltown, Iowa. Client, Griffith Co.

Reinbeck Methodist Church, Reinbeck, Iowa. Client, Griffith Co.

Creston Presbyterian Church, Creston, Iowa. Client, Griffith Co.

Little Rock School addition, Little Rock, Iowa. Client, Griffith Co.

Immanuel Lutheran Church, Davenport, Iowa. Client, Parish & Richardson.

Rippey School add'n, Rippey, Iowa. Client, Smith, Voorhees, Jensen & Silletto.

LOUISIANA

Louis N. Goodman and Associates. North pier and tower, Moisant International Airport, New Orleans, La. (First contract of $8,000,000 development.) $892,000. Client, Goldstein, Parham and Labouisse, Architects.

NEW YORK

Greenhut & Taffel. Public School #129, reinforced concrete, Manhattan, N.Y. $1,500,000. Client, Board of Education.

Herman Kron, Consulting & Architectural Engineer. One-story brick building for gas station, lubritorium, auto laundry, and office. Will be of front brick. Building to be equipped with unit heater. Size, 71.6 x 28 ft, Queens, N.Y. $20,000. Client, L. B. Oil Co., Inc.

Fred S. Dubin Associates. Utilities planning master plan, University of Buffalo, N.Y. Client, architect, Paul Schweikher and Carlin.

Preliminary planning, University of Buffalo Library, theater, reactor building. $6,000,000. Client, architect, Schweikher & Carlin.

Nussbaumer-Clarke & Velzy. Water intake 7 ft dia, 6000 ft long, and main water pumping station. $2,000,000. Client, Oswego, N.Y.

Garbage and refuse incinerator, 600 tons capacity. $1,500,000. Client, Rochester, N.Y.

Various water mains, 10, 12, 16, 20, 24 in., in trunk distribution system. $1,500,000. Client, Erie County Water Authority, N.Y.

Gruenwald Associates. Milk processing plant. $50,000. Client, Queensboro Farm Products, Inc., Long Island City.

Power plant. $125,000. Client, Queens Farms Dairy, Inc., Pierrepont Manor.

NORTH DAKOTA

L. W. Burdick. Concrete water storage reservoir, water supply line, and distribution lines, Bottineau, N.D. $350,000. Client, City of Bottineau.

Swimming pool, Bismarck, N.D. $250,000. Client, City of Bismarck.

Sewage disposal system, Esmond, N.D. $86,000. Client, City of Esmond.

OREGON

Ray W. Preston. Woodburn, Ore. cold storage plant addition ($15,000). Hillsboro, Ore. cold storage plant addition ($36,000). Electrical substation and distribution only for storage buildings. Refrigeration for total of 23 million pounds of strawberries added to existing facilities. Client, Terminal Ice & Cold Storage Co.

PENNSYLVANIA

The Ballinger Co. and Ballinger-Meserole Co. Plans for multi-unit buildings for Philadelphia Food Distribution Center, Philadelphia, Pa. Client, Philadelphia Food Distribution Center.

TEXAS

Marshall E. Parker. Cathodic protection system, gas gathering and injection system (buried steel piping), Brooks and Jim Wells Counties, Texas. Client, La Gloria Oil and Gas Company.

Forrest and Cotton. Plans and specifications for Terminal Area development, Hanger Area development, N/S runway extension and taxiway; report, engineering study, plans and specifications for dual runway. Love Field, Dallas, Texas. $7,000,000. Client, City of Dallas.

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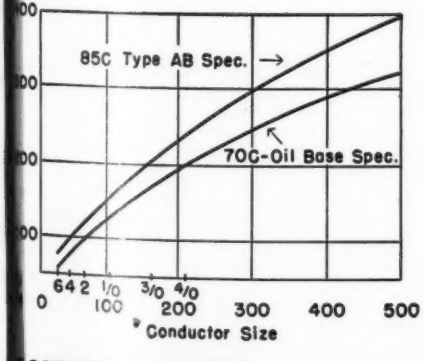
Greater current-carrying capacity of Type AB butyl high-voltage cable helps users cut costs, use new or existing facilities more efficiently.

Cable that takes the squeeze out of crowded conduits



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Now you can obtain the same amount of current with a smaller cable... or more current with the same size cable—with Anaconda's Type AB butyl high-voltage insulation.

For Anaconda Type AB butyl-insulated cable is recommended for operation at 85C *operating temperature.* Industry specifications recommend 70C for oil-base insulations. Thus, as the curves on the chart show, Type AB delivers 22% more current-carrying capacity . . . and more amps per dollar.

New Engineering Bulletin EB-27 gives you full details on performance of Type AB insulation in 15 Industry Specification Tests. Ask the Man from Anaconda for your copy. Or write: Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York.

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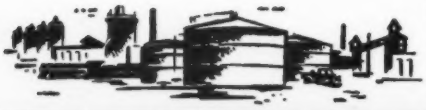

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Wherever a safe footing is required

Grip-Strut circular stairway on Shell Oil tank in Portland, Ore.

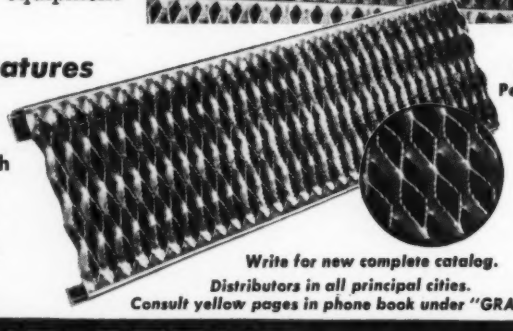
See how Shell Oil uses Grip-Strut for a safe ramp between tanks.

View looking down circular stairway on Shell Oil tank shown above.

SAFETY GRIP-STRUT is the new basic material, all in one piece (including channels), not welded, riveted or expanded in steel or aluminum, in standard sizes and gauges. Safety GRIP-STRUT presents an open space, in a diamond pattern, in excess of 55% of the area for ready access of light and air and gives a positive NON-SKID footing in all directions. Ideal for work platforms, stair and ladder steps, flooring, balconies, catwalks, machinery guards, fire escapes and for original equipment safety treads.

Important Safety Features

- ★ Fire proof
- ★ Slip proof
- ★ Maximum strength
- ★ Minimum weight
- ★ Easy to stand on
- ★ Cool in summer—warm in winter



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GRIP-STRUT division
THE GLOBE COMPANY • *Manufacturers since 1914*
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tion of equalizer culverts under Irving Blvd. and Westmoreland Ave. near East Levee. $40,000. Client, Dallas County Flood Control District.

WASHINGTON

Marshall E. Parker, Cathodic protection system, steel water supply line, Port Townsend, Wash. Client, Crown Zellerbach Corp. and City of Port Townsend, Wash.

WYOMING

Associated Engineers. New dial telephone system, including 30 miles new line construction and associated dial equipment offices. $50,000. Client, Cokeville Tele. Co., Inc., Cokeville.

New 69 kv transmission line near Powder River, Wyo. $300,000. Client, Hot Springs Co. Elec. Coop., Thermopolis, Wyo.

FOREIGN

Ballinger-Meserole Co. Plans for 700,000 sq ft of food warehousing in the New Central Market, San Juan, Puerto Rico. Client, Puerto Rico Dept. of Agriculture and Commerce and the Puerto Rico Ports Authority.

The J. G. White Engineering Corp. Engineering and design of a 53,000 kw steam electric generating plant for the General Manuel N. Savio Steel Mill of Sociedad Mixta Siderurgia Argentina at San Nicolas, Argentina. Process steam and cooling water supply and outdoor distribution substation with supplementary 18,000 kw, 132 kv tie to local utility. Client, Westinghouse Electric International Co.

Pipe Line Engineering Co. Marine Terminal for tanker loading, Lake Maracaibo, Venezuela. $17,000,000. Client, Creole Petroleum Corporation, Caracas, Venezuela.

R. J. Tipton Associated Engineers, Inc. Design and supervision of construction 14,000 kw hydroelectric plant, Ecuador. $6,000,000. Client, Empresa Electrica Quito, Ecuador.

Supervision of design and construction, second stage Quiroz irrigation project in Peru, involving earth fill dam and 250 miles of canals and laterals. $28,000,000. Client, Ministerio de Fomentoy Obras Publicas, of Peru.

Muzzillo and Tizian. Barranquilla General Hospital, Barranquilla, Columbia. $4,000,000. Client, architect, Ekmel Moran Associates and Lignarolo-Pacini-Santodomingo Ltda.

Arthur G. McKee & Co. Complete modernization and expansion of Esso's Belot refinery in Havana, Cuba. Client, Esso Standard Oil, S.A.

Airways Engineering Corp. Design and supervision of construction for airport at Asuncion, Paraguay. $1,200,000. Client, Government of Paraguay.

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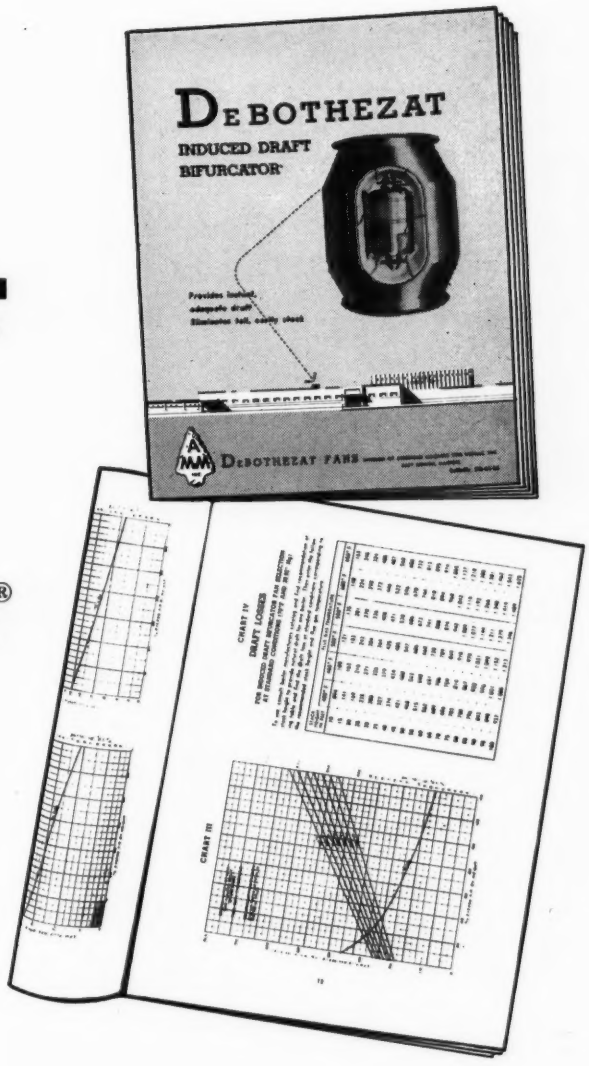

A valuable working tool for both the engineer and contractor. This new 20-page catalog gives all manufacturers' organizations boiler code ratings reduced to their common relationship of BTU/HR delivered to the steam.

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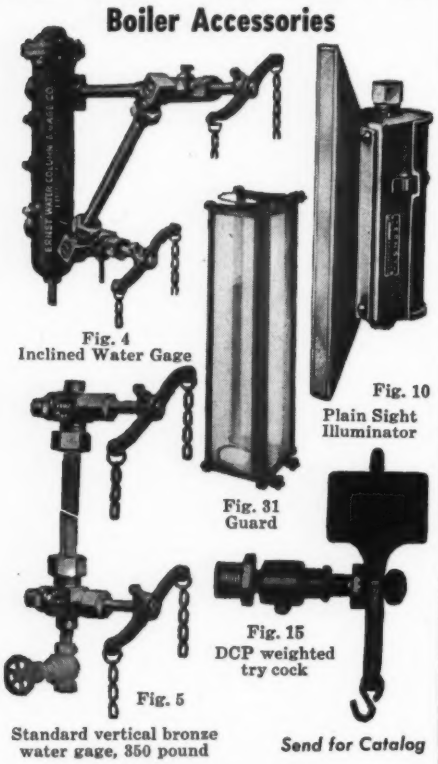

Fig. 4
Inclined Water Gage

Fig. 10
Plain Sight Illuminator

Fig. 31
Guard

Fig. 15
DCP weighted try cock

Fig. 5

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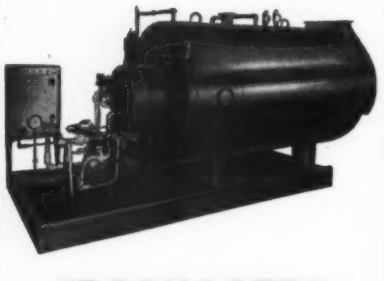

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ELECTRONIC DATA PROCESSING FOR BUSINESS AND INDUSTRY, by Richard G. Canning; John Wiley & Sons, Inc.; 332 pp.; $7.00.

Reviewed by Charles E. Stewart
Mathematical Analyst,
Armour Research Foundation

The book is an excellent text for prescribing a course of action for the practicing engineer engaged in investigating the methods of management for use of electronic data processing equipment. For the engineer not acquainted with the language of management, the book is difficult on a first reading. The reviewer believes that Chapters 6 and 7, in which design considerations of the electronic system are discussed, are most likely to be formidable for the uniniated. However, after diligent study, these too are found to be palatable.

The book's objective is to answer the following three questions:
¶ What is electronic data processing?
¶ What can it do for a company?
¶ How should a company go about investigating it?

These questions are to "aid management in making a fair, practical, realistic evaluation of electronic data processing." This the author seems to have done. Since the emphasis of the book is placed on the *systems approach,* (the italics are the authors) i.e., "an engineered solution to the data processing problem rather than a patchwork solution," it is recommended highly for those wishing to become acquainted with the field of electronic data processing for business and industry.

The book should appeal to a wide class of readers concerned with investigating electronic data processing. Excellent summaries are interpersed throughout the chapters, and at the end of most chapters. These summaries also should make the book attractive to the busy executive.

The author indicates the benefits that management can gain almost immediately from electronic computers, and the gains that may be expected from an Operations Research study in the decision-making area. However, since the book is not concerned with decision-making per se, only a short chapter is devoted to the discussion of Operations Research and management.

On the whole, the book does an excellent job of presenting the systems approach to electronic data processing. It should prove very valuable as a reference.

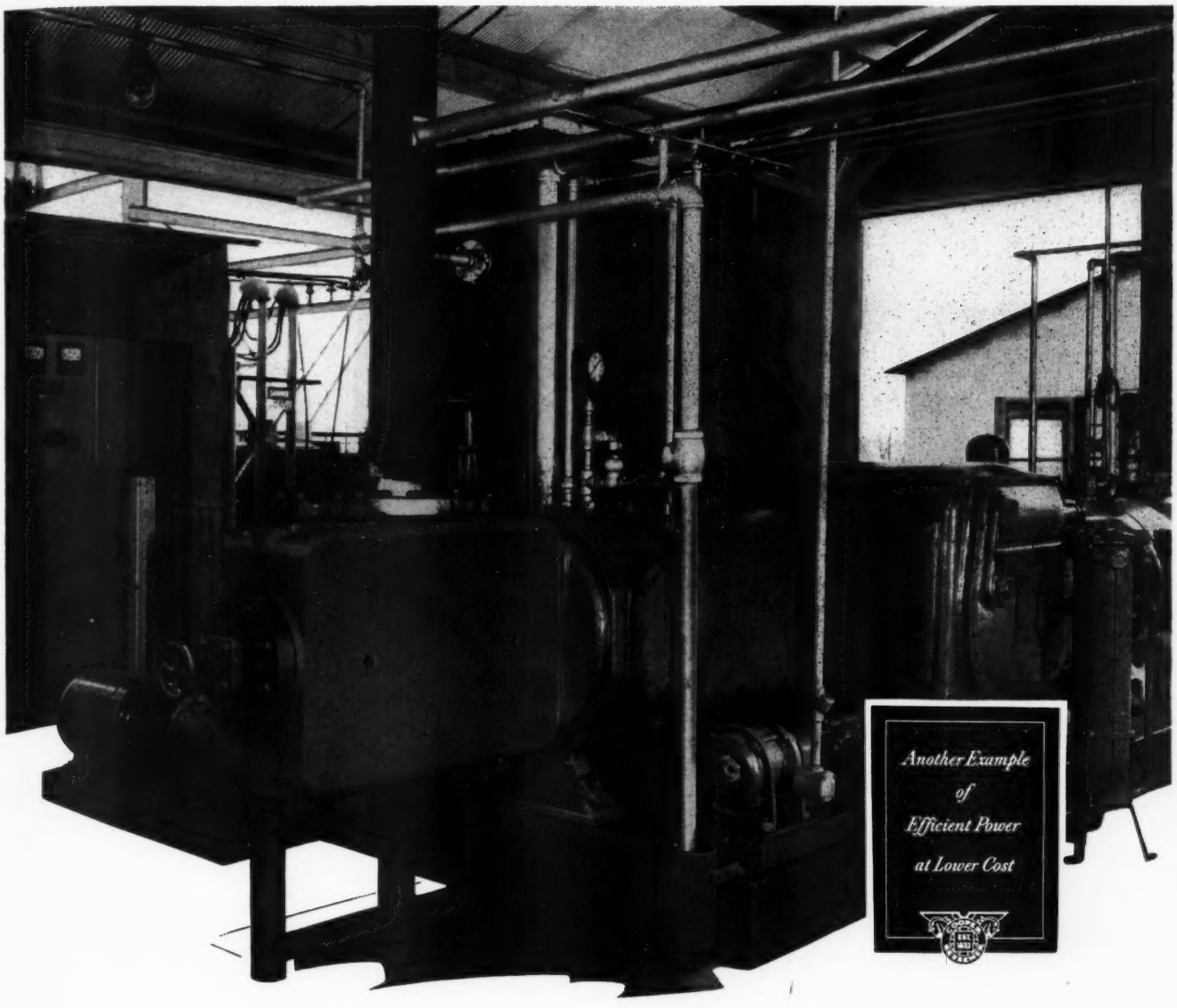
•

THE STEEL SKELETON, Vol. II, by J. F. Parker, M. R. Horne, and J. Heyman; Cambridge University Press, American Division; 408 pp.; $12.00.

Reviewed by W. S. Woodward
Seelye, Stevenson, Value & Knecht

Written by three British authors, this book is the second volume dealing with the subject of limit design in structural steel. Volume I covered the development of design methods down to the Steel Structures Research Committee's "Recommendations" of 1936. This volume brings the subject up-to-date in a very comprehensive manner.

The subject of structural design based on ultimate load carrying capacity, usually called limit design, is a timely subject and one that has been seriously proposed as the logical design approach. Earlier engineering was based on limit design,



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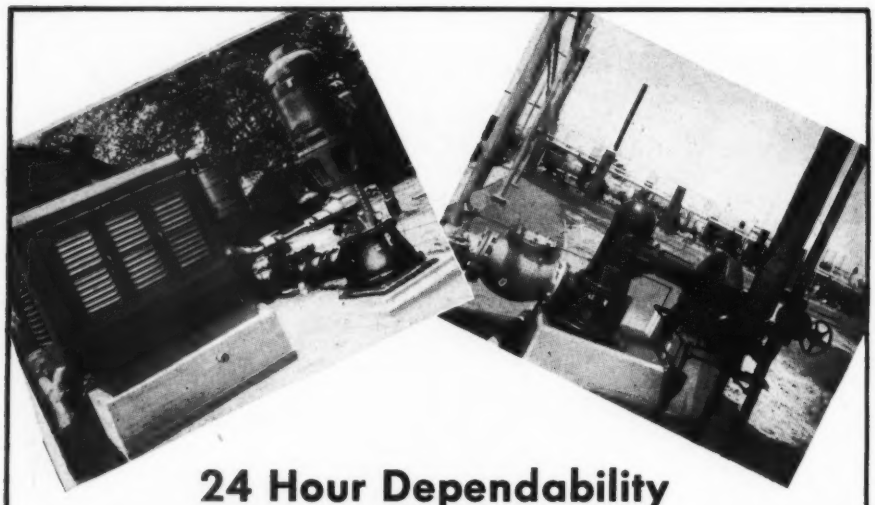

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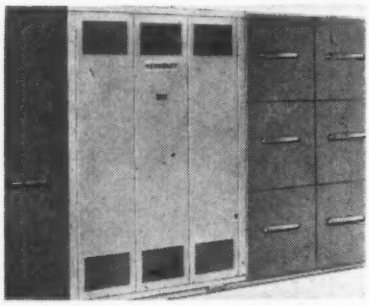

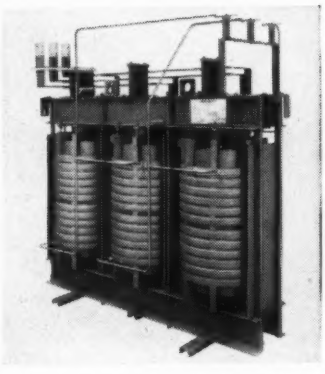

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such as Euler's contribution on the strength of columns. This design method presupposes ductile or semi-ductile deformations where the analysis is changed from permissible stresses (elastic theory) to safe deformations. As is well known, the elastic theory involves many assumptions that do not check with fact.

The behavoir of a structural frame as a unit is governed largely by the manner in which the connections are made. Welding has made possible a connection in which the full strength of the members is more readily developed. It follows that continuous structural elements are susceptible to a more accurate analysis than other connections.

A few of the chapter headings will give some idea of the material:

Simple Plastic Theory of Bending
Continuous Beams
Rectangular Portal Frames
The Pitched-Roof Portal
Shakedown (Analysis of alternate plasticity and increment collapse)
Elastic-Plastic Theory of Stanchions (Bent in one plane and about two axes of symmetry)
The Load Factor

As an illustration of how the subject matter is treated, the chapter on Rectangular Portal Frames might be cited as typical. After going through the assumptions and theory of pinned-base and fixed-base rectangular portals, the author takes up the analytical method of design. He then gives the experimental verification for miniature frames, and for full-scale frames, including photos.

While the book gives the mathematics involved, it does not become so theoretical that the average practising engineer gets lost in the clouds of calculus and higher mathematics. The practical aspects are valuable and are especially interesting.

It might be well to quote the author's definition of collapse as this is the basis of the theory. This is "A structure is on the point of collapse when finite deformation of at least part of the structure can occur without any change in the loads."

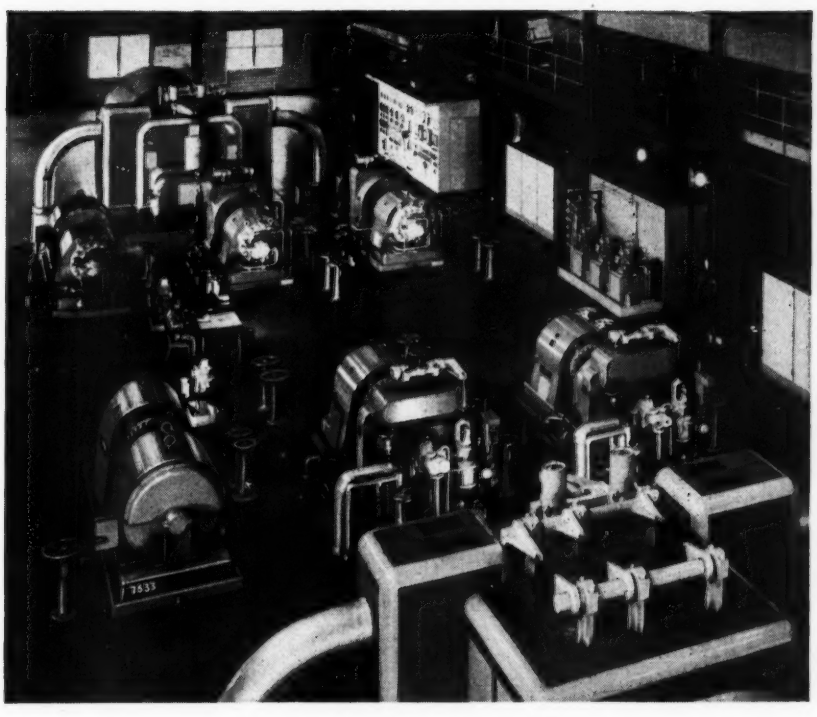
There is no doubt that limit design is going to be used more and more by structural designers as time goes on and as the unknown or doubtful features become known or are further developed by use. It is thus imperative for the progressive engineer to keep abreast of the latest developments in his specialty. To the structural engineer a book of this kind is required study.

ALSO AVAILABLE

NATURAL TANGENTS; Boyce Engineering Associates; 91 pp.; $12.00.

This is a new tabulation of natural tangents developed for survey computations and based upon field information obtained by instruments

What makes a barrel-type boiler feed pump *stay in service?*



Here are some of the design features that assure dependability

Today's modern multi-stage centrifugal pumps for boiler feed service are the result of years of research and design. To provide efficient service *plus* dependability, De Laval has incorporated these important features in its barrel-type pump.

Double Volute Diaphragms

Double volute diaphragms provide for radial hydraulic balance and assure a continuous rising head characteristic from the design point to shut-off. *RESULT—Higher efficiencies are maintained over a wider range of operation than are generally obtained with other forms of velocity pressure conversion.*

Individual Diaphragm Bolting

Elimination of rabbet fits and gaskets permits straight metal-to-metal contact of adjacent lapped faces of the diaphragms which are individually bolted together to maintain tight joints and ease of assembly. *RESULT—Positive assurance against inner case leakage, complete elimination of misalignment causes and a minimum of distortion from sudden temperature changes.*

Positive Sealing Between Suction and Discharge Chamber

Inner assembly is held at the inner high pressure joint at the suction end of the barrel, against a flexitallic gasket, with through bolts. The joint between the suction and discharge chambers is made tight during assembly—remains tight whether pump is operating or idle. *RESULT—No possibility of leakage or gasket loosening due to changes of force on the inner joint.*

Bare Shaft

Bare shaft construction with split ring-shrink fit method of impeller mounting permits a scalloped shaft design and eliminates the need for spacer sleeves between impellers. *RESULT—Better hydraulic conditions at the eye of the impeller and elimination of spacer sleeves—the greatest cause of shaft warpage.*

Wearing Rings

Diaphragms and impellers have renewable wearing rings. Impeller rings are threaded on the impeller hubs against rotation, and diaphragm rings are held by a breech lock fit in the diaphragms. *RESULT—Construction permits renewal of original clearances without major part renewal or modification. Labyrinth type diaphragm ring results in minimum leakage over a longer period of time than with close clearance flat rings.*

IMO Oil Pump

A De Laval IMO pump designed for high speed operation is direct-connected to the outboard end of the barrel pump shaft, and is sized to lubricate both pump and driver bearings. *RESULT—Quiet, pulsation-free, positive displacement IMO pumps, assures positive lubrication and eliminates the need of extra shaft length and mechanical complications required by gear drive lube oil pumps.*

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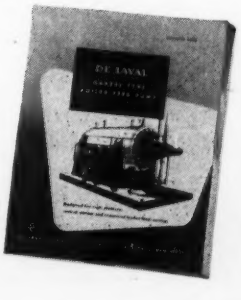

This De Laval bulletin on the barrel-type boiler feed pump covers all major design points . . . has cross-section cut-away illustration for easy reference. Write on your business letterhead for your copy of Bulletin 1506 to De Laval Steam Turbine Company, 894 Nottingham Way, Trenton 2, New Jersey.

that measure field direction to one-tenth minute of arc.

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SURVEYING, 2nd Ed., by Philip Kissam; McGraw-Hill Book Co., Inc.; 482 pp.; $5.75.

Theory and basic principles of surveying are stressed throughout this book. Exact and complete derivations are used, and principles are clearly defined and illustrated.

This second edition gives a more complete treatment of the theory of errors. New material has been added on the compass and the earth's magnetic field. Of particular interest to the consultant is a new chapter dealing with "The Elements and Use of Aerial Photographs."

•

AIR POLLUTION HANDBOOK, Edited by Paul L. Magill, Francis R. Holden, and Charles Ackley; McGraw-Hill Book Co., Inc.; 720 pp.; $15.00.

An impressive list of scientists and engineers have authored the various chapters in this reference handbook. Causes, effects, and control of air pollution are discussed with emphasis on city planning and industrial plant location. Topics include epidemiology of air pollution, effects of air pollutants on farm animals and plants, sampling procedures, analytical and experimental test methods, equipment and processes for abating air pollution, and a review of basic legal considerations involved.

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The following Smoley's Tables Handbooks have been revised and expanded as of 1956. Publisher is C. K. Smoley & Sons, Inc.

PARALLEL TABLES OF LOGARITHMS AND SQUARES (688 pp.), $6.00.

FIVE DECIMAL LOGARITHMIC TRIGONOMETRIC TABLES (200 pp.), $1.50.

PARALLEL TABLES OF SLOPES AND RISES (532 pp.), $6.00.

SEGMENTAL FUNCTIONS (436 pp.), $5.00.

THREE COMBINED TABLES (First three books in one volume) (1124 pp.), $10.00.

FOUR COMBINED TABLES (Four books in one volume) (1424 pp.), $12.00.

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ALCOA ALUMINUM HANDBOOK; Aluminum Company of America; 176 pp.; free of charge.

A successor to the now discontinued "ALCOA Aluminum and Its Alloys," this book contains information on alloy standards as well as the properties, sizes, and tolerances of mill products usually produced from them. Sections on wrought and casting alloys contain typical mechanical, tensile, and chemical properties of ALCOA alloys with tables of characteristics and typical uses. For a copy, write to ALCOA at 781 Alcoa Building, Pittsburgh 19, Pa.

FILMS

"NEW HORIZONS IN PLASTERING," The Vermiculite Institute, 16 mm, sound and color, 20 minutes.

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"MODEL TEST PIT FOR 400 MGD PUMPS," Byron Jackson Pumps, Inc., sound and color, 18 minutes.

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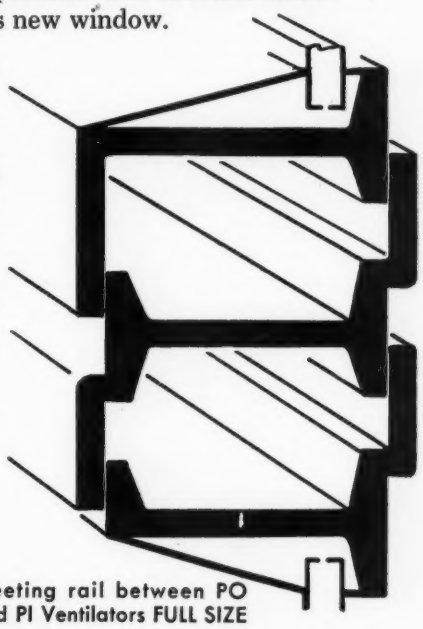
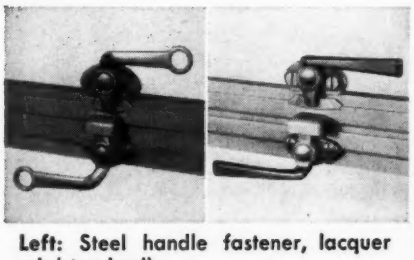


Meeting rail between PO and PI Ventilators FULL SIZE



Left: Steel handle fastener, lacquered (standard)
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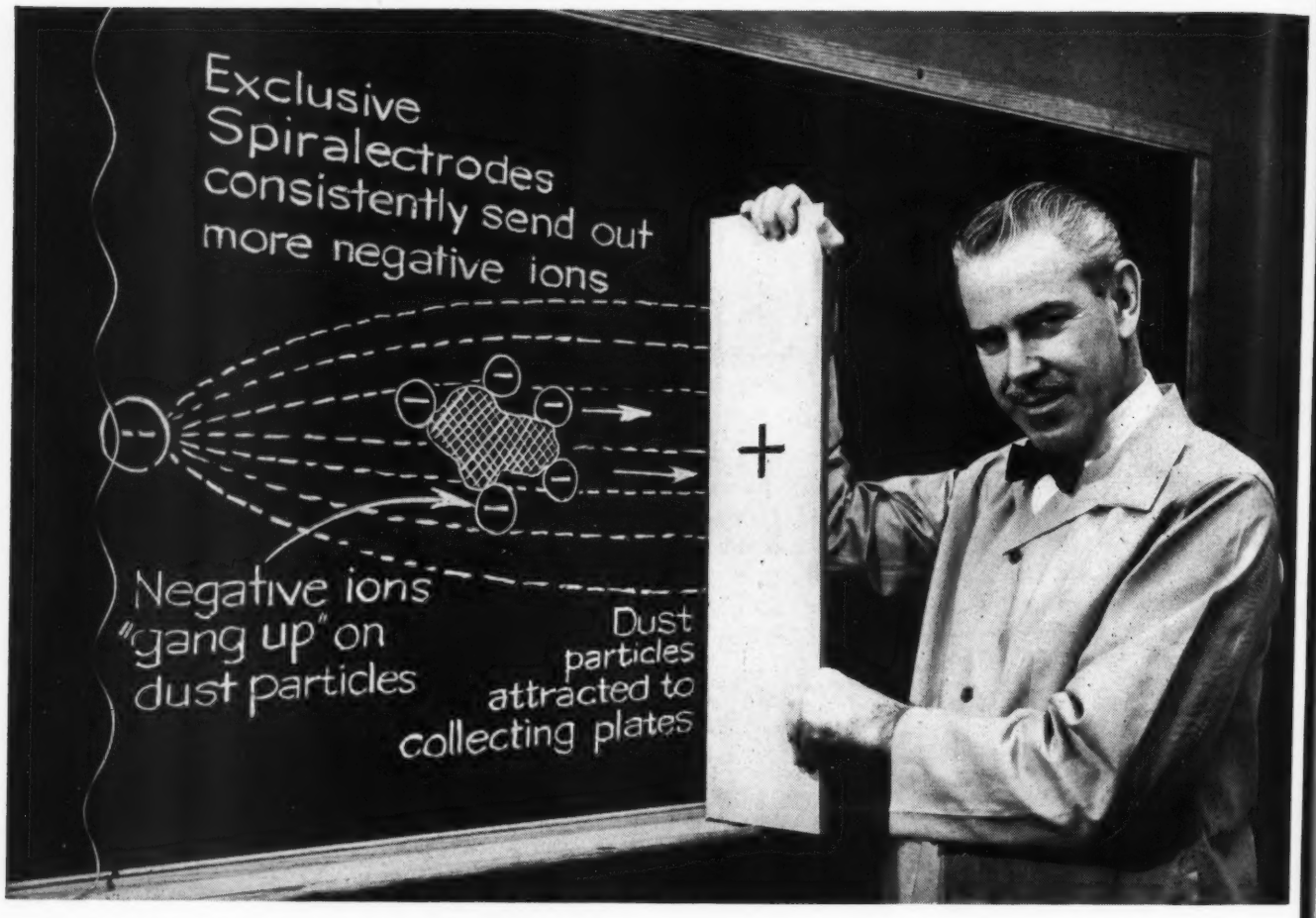

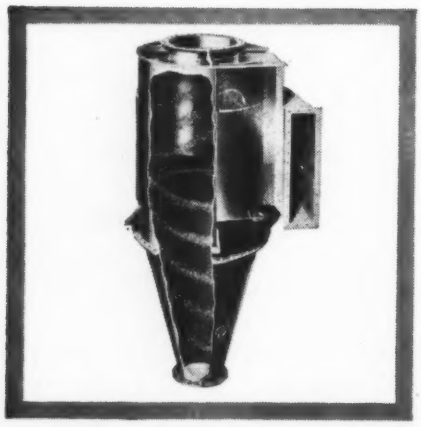

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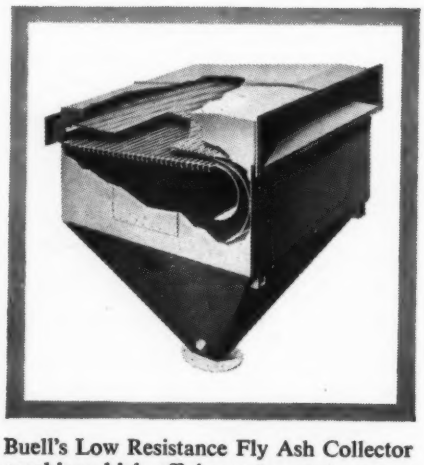

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Date	Sponsor	Event	Location
Oct. 1-5	American Institute of Electrical Engineers	Fall General Meeting	Morrison Hotel Chicago, Ill.
Oct. 8-12	Pan American Federation of Engineering Societies	Fourth Convention	del Prado Hotel Mexico City, Mexico, D.F.
Oct. 11-12	Armour Research Foundation of Illinois Institute of Technology	National Noise Abatement Symposium	Hotel Sherman Chicago, Ill.
Oct. 15-19	American Society of Civil Engineers	Annual Meeting	Pittsburgh, Pa.
Oct. 16-18	American Institute of Electrical Engineers	Conference on Magnetism and Magnetic Materials	Hotel Statler Boston, Mass.
Oct. 18-19	Institute of Management Sciences	3rd Annual International Meeting	Hotel Statler Los Angeles, Calif.
Oct. 18-19	Armour Research Foundation of Illinois Institute of Technology	12th Annual National Conference on Industrial Hydraulics	Hotel Sherman Chicago, Ill.
Oct. 22-24	American Standards Association	38th Annual Meeting	Hotel Roosevelt New York, N. Y.
Oct. 23	Association of Consulting Chemists and Chemical Engineers	Symposium "How Consultants' Know-How Applies to Packaging of Consumer Goods" and Annual Meeting	Belmont Plaza Hotel New York, N. Y.
Oct. 24-25	Armour Research Foundation of Illinois Institute of Technology	Computer Applications Symposium	IIT Campus Chicago, Ill.
Oct. 24-25	American Concrete Institute	9th Annual Regional Meeting	Sheraton-Mount Royal Hotel Montreal, Canada
Nov. 8-9	University of Wisconsin	Drafting Practices Institute	Campus Madison, Wis.
Nov. 12-16	National Industrial Development Exposition, Inc.	Exposition	New York Coliseum New York, N. Y.
Nov. 25-30	American Society of Mechanical Engineers	Annual Meeting	Hotel Statler New York, N. Y.

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